2012 Furbearer Program Annual Report

MISSOURI DEPARTMENT OF CONSERVATION

Resource Science Division

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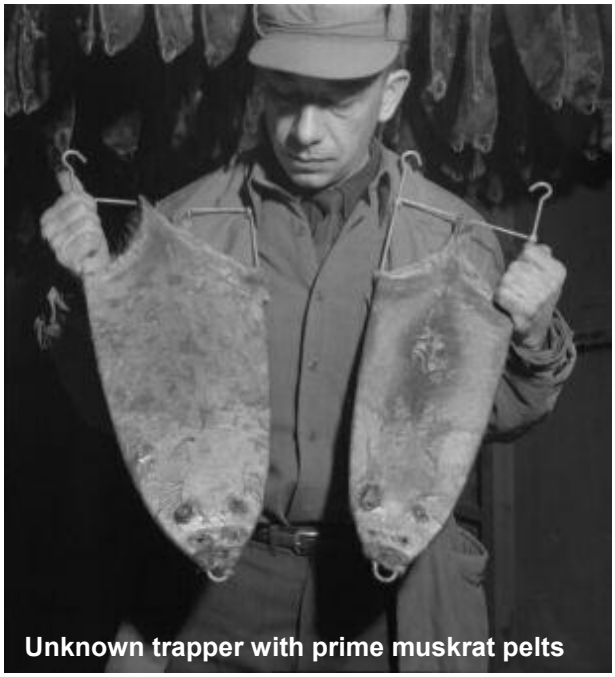
INTRODUCTION

Missouri's wild fur market has been monitored annually since 1940, with some information dating back to 1934. Over time, we have witnessed tremendous fluctuations in the harvests of Missouri's primary furbearing animals as both market and social trends change. We monitor the fur market using mandatory fur dealer transaction records, mandatory pelt registration of bobcats (since 1980) and river otters (since 1996), and information gathered at fur auctions. Most of the information in this report is based on harvest from trappers although some species are also hunted.

The number of Fur Dealer Permits issued by the Missouri Department of Conservation peaked at 1,192 during the 1945-46 season. In 2011, we sold 44 Resident and five Non-Resident Fur Dealer Permits. The number of Resident Trapping Permits sold peaked at 13,248 in 1980-81 (permits were first required in 1953), and reached a low of 2,050 in 2000. During the 2011-12 trapping season, we sold 7,543 Resident and 250 Non-Resident Trapping Permits (Table 1).

Total pelts harvested reached 834,935 in 1940-41 (over 70% were opossum and skunk pelts), and again reached the second highest peak in 1979 at 634,338 when average raccoon pelt values were estimated at $27.50. The overall value of the furbearer harvest also peaked in 1979-80 at over $9 million. Pelt values declined dramatically during the late 1980s and through the mid-1990s; as a result the number of participants fell to all-time lows. Current market trends suggest that pelt values for many of the commonly hunted and trapped species are regaining some strength as China's participation in the fur market increases.

In addition to harvest information, wildlife population trends are monitored using archer's indices and sign station surveys. Archer's indices are based on annual wildlife observation reports sent in by cooperating bow hunters. Sign station surveys are run each September by Conservation Department staff in 25 counties. A more detailed account of sign station surveys and archer's indices can be found in Section 2.



Unknown trapper with prime muskrat pelts

Also contained in Section 2 are updates and progress summaries for various furbearer-related research projects, monitoring efforts, or items of interest. These are only for informational purposes and should be considered draft reports. For more information on any of these draft reports please contact Jeff Beringer at jeff.beringer@mdc.mo.gov.

Changes for the 2011-12 furbearer trapping season include: trappers can now use their Conservation Number instead of their name and address on trap tags, clarified language that only live red fox, gray fox and coyotes may be taken with cable restraints from February 1 through the end of the

month and that cable restraints can be used during the entire furbearer trapping season and possession, transportation and sale of furs throughout the year are now authorized with a valid trapping or hunting permit.

SECTION 1:
Missouri Furbearer Status 2011-2012

FUR HARVEST COMPARISONS

To buy and sell fur in Missouri, fur dealers must purchase a commercial permit from MDC. The permit requires fur dealers to record and submit records of all fur transactions. Starting in June of 2011 Fur Handler permits were no longer required and trappers could hold and sell fur throughout the year with a valid trapping or hunting permit. Data collected from fur dealers gives us an estimate of furbearer harvest. In addition, harvest numbers for bobcats and otters are gathered from mandatory pelt registration required by the Convention on International Trade of Endangered Species (CITES).

A combination of favorable weather and strong fur prices resulted in high participation by hunters and trappers this past fall. We sold over 7,500 trapping permits, which is a 23-year high. We also had an all-time record harvest for otters with 4,233 animals harvested, which is a 64% increase over last year and a 265% increase over the last 2 years. We had near record harvests by trappers for a number of species including raccoon, bobcat and coyote. Participation by hunters has also been increasing. Survey data from 2011 suggest 10,612 people hunted raccoons and 23,600 pursued coyotes.

Table 1. Furbearer harvest and pelt prices in Missouri over the last three years.

	FUR SEASON					
Species	2011-12		2010-11		2009-10	
	Number of pelts sold or registered*	Pelt Prices from MTA Auctions	Number of pelts sold or registered*	Pelt Prices from MTA Auctions	Number of pelts sold or registered*	Pelt Prices from MTA Auctions
Raccoon	158,356	$10.00	109,586	$10.98	47,919	$12.20
Opossum	12,185	$1.23	9,295	$1.70	4,491	$2.22
Muskrat	23,031	$9.49	20,641	$6.21	9,877	$6.91
Coyote	4,494	$14.93	4,205	$11.04	1,520	$10.95
Beaver	7,572	$13.47	5,464	$9.94	3,535	$13.75
Mink	1,499	$18.15(m) $10.01(f)	1,085	$14.18(m) $7.21(f)	614	$10.67 (m) $5.41 (f)
Red Fox	1,191	$30.08	1,040	$16.78	479	$14.82

Gray Fox	757	$20.26	709	$18.02	325	$15.08
Striped Skunk	451	$1.80	383	$1.87	212	$2.75
Badger	62	$15.63	59	No price reported	23	$3.50 (1 sold)
Bobcat*	4,199	$77.66	3,888	$45.21	2,131	$36.30
River Otter*	4,233	$87.80	2,573	$46.95	1,159	$37.84
Trapping permits sold (resident)	7,549		5,618		4,437	

* Pelts sold (except bobcat and otter where harvest is based on CITES registration) is based on reports received from the 41 Fur Buyer Permittees.

MISSOURI FUR AUCTION PRICES

Fur auctions are held by the Missouri Trappers Association (MTA) two to three times yearly. Prices are averaged from all fur sold, including green, finished and damaged (Table 2). Average pelt prices were higher this year for most species (Table 3). Opossum, skunk and beaver pelt prices declined 20% or more from last year.

Table 2. Range of furbearer pelt prices in Missouri during the 2011-12 trapping season.

		2012 Auction Prices		Average Prices for 2012	Change in Price from Last season
	Total Number of Pelts Sold	28-Jan	12-Feb		
Species					
Raccoon	16,692	$10.64	$9.35	$10.00	-8.93%
Opossum	1,430	$1.57	$.89	$1.23	-27.65%
Muskrat	2,632	$9.51	$9.47	$9.49	52.82%

Coyote	365	$15.60	$14.26	$14.93	35.24%
Beaver	816	$13.36	$13.57	$13.47	-5.01%
Mink – Male	119	$17.62	$18.67	$18.15	28.00%
Mink – Female	31	$11.52	$8.50	$10.01	38.83%
Red Fox	100	$26.46	$33.70	$30.08	79.26%
Gray Fox	42	$20.60	$19.91	$20.26	12.43%
Striped Skunk	72	$2.19	$1.41	$1.80	-3.74%
Badger	3	$22.00	$9.25	$15.63	*346.57%
Bobcat	146	$81.21	$74.10	$77.66	71.78%
Otter	457	$95.02	$80.35	$87.69	87.01%

*Badger price reflects increase from 2009-10 season, as no price data was available from 2010-11.

Table 3. Comparison of average furbearer auction prices over the last five trapping seasons.

	Average Price Per Season					5 year average
Species	2011-12	2010-11	2009-10	2008-09	2007-08	
Raccoon	$10.00	$10.98	$12.20	$9.77	$17.95	$12.18
Opossum	$1.23	$1.70	$2.22	$1.98	$1.91	$1.81
Muskrat	$9.49	$6.21	$6.91	$3.08	$3.29	$5.80
Coyote	$14.93	$11.04	$10.95	$8.75	$13.34	$11.80
Beaver	$13.47	$9.94	$13.75	$11.84	$15.17	$12.83
Mink (male)	$18.15	$14.82	$10.67	$7.87	$10.59	$12.29
Red Fox	$30.08	$16.78	$14.82	$13.30	$15.46	$18.09
Gray Fox	$20.26	$18.02	$15.08	$17.85	$34.88	$21.22
Str. Skunk	$1.80	$1.87	$2.75	$3.73	$3.61	$2.75
Badger	$15.63		$3.50	$17.50	$13.17	$12.45
Bobcat	$77.66	$45.21	$36.30	$23.68	$56.93	$47.96
Otter	$87.80	$46.95	$37.84	$26.91	$32.00	$46.30

RACCOON POPULATION AND HARVEST TRENDS

Raccoon harvest, including trapping, for the 2011-12 season was 158,356, up 44.50% from the 2010-11 season and up 221.27% from the 2009-10 season (Figure 1). The increase in trapping permit sales was likely a result of stronger pelt prices from last year and the increased access afforded to trappers that are using dog-proof traps. We also saw more speculation this year as many fur dealers were able to clear their inventory and were again buying from local fur trappers.

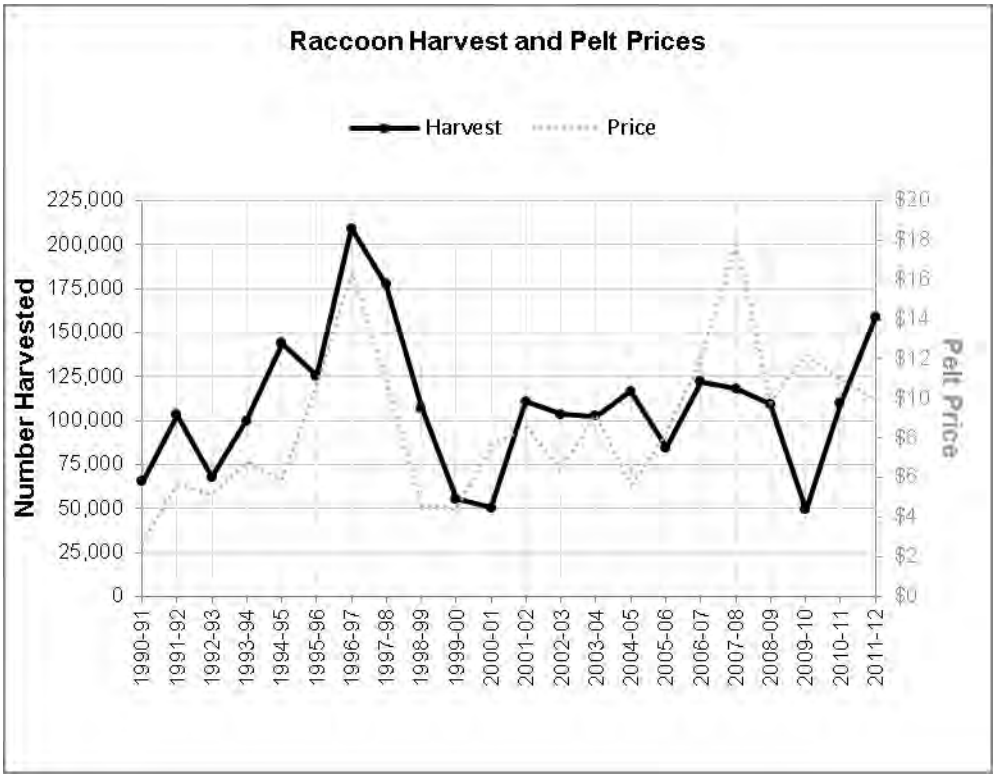


Figure 1. Comparison of raccoon harvest and pelt prices over the last 22 years.

Raccoon indices based on observations from bowhunters continue to increase. During 2011 we recorded the highest index for raccoon sightings since we started collecting data in 1983 (Figure 2). Despite some annual flux long-term population trends seem to be increasing. The presence of raccoon tracks at furbearer sign stations reached its highest number ever in 2011 with an index of 188.92. Overall, the number of raccoon visits per 1,000 operable stations has nearly tripled in the last 30 years as this generalist continues to thrive.

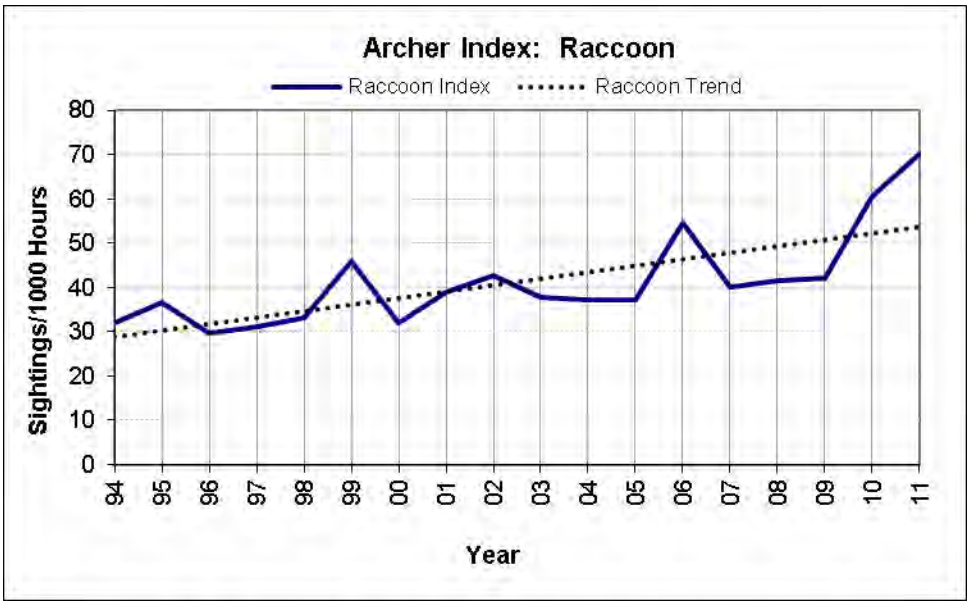


Figure 2. Raccoon population trends based on our bowhunter observation survey.

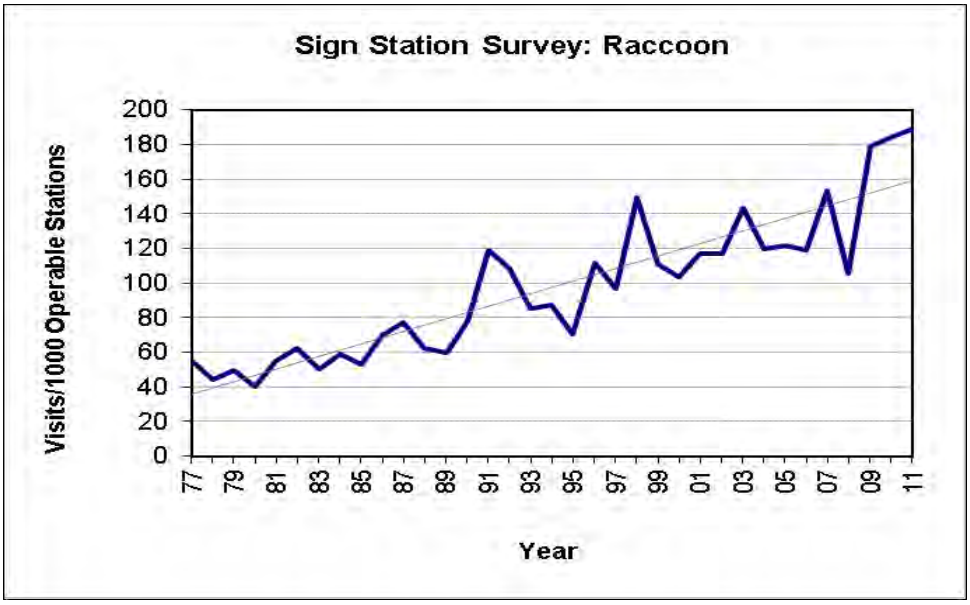


Figure 3. Raccoon population trends based on sign station surveys.

COYOTE POPULATION AND HARVEST TRENDS

Coyote harvest during the 2011-12 season (4,494) was up, increasing 6.87% from the 2010-11 season (Figure 1). Weather likely affected coyote trapping as we experienced warm dry weather for much of the season. Although coyote pelt prices averaged only $15.00, many trappers still enjoy the challenge of catching coyotes. The use of cable restraints has increased coyote harvest for the fur market and for the live market associated with hound running pens. Trend data for coyotes suggest populations are stable but higher than those observed during the mid-1970s (Figures 2 and 3). Mange in both coyotes and red fox is reported each year but major outbreaks have not been confirmed for 2012.

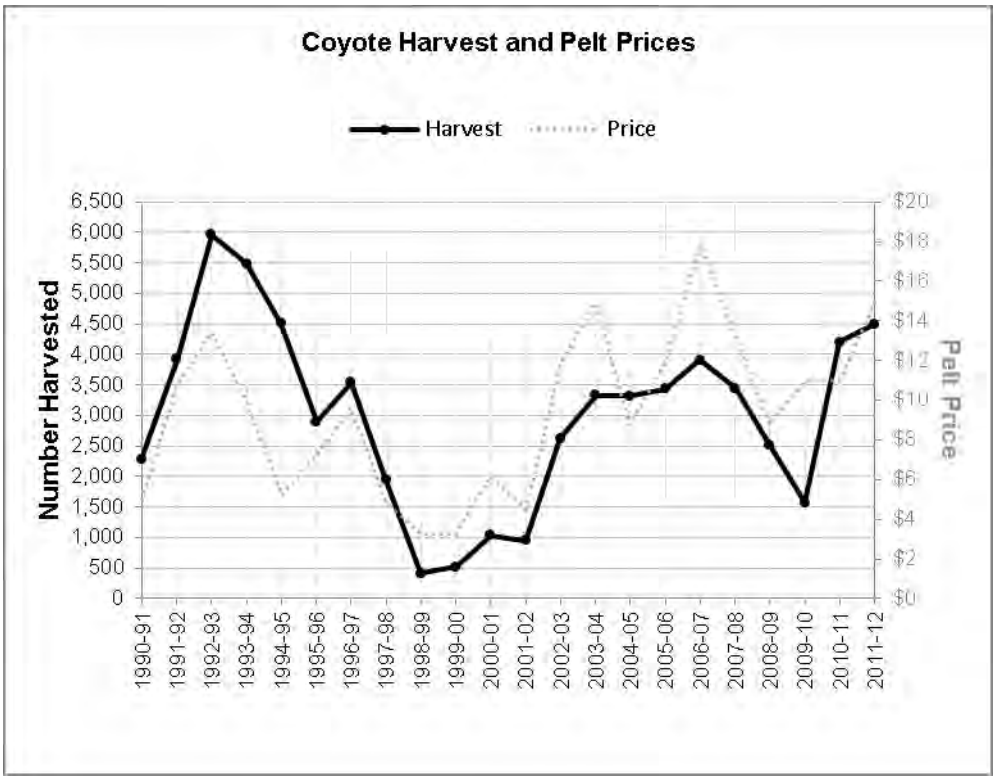


Figure 1. Comparison of coyote harvest and pelt prices over the last 22 years.

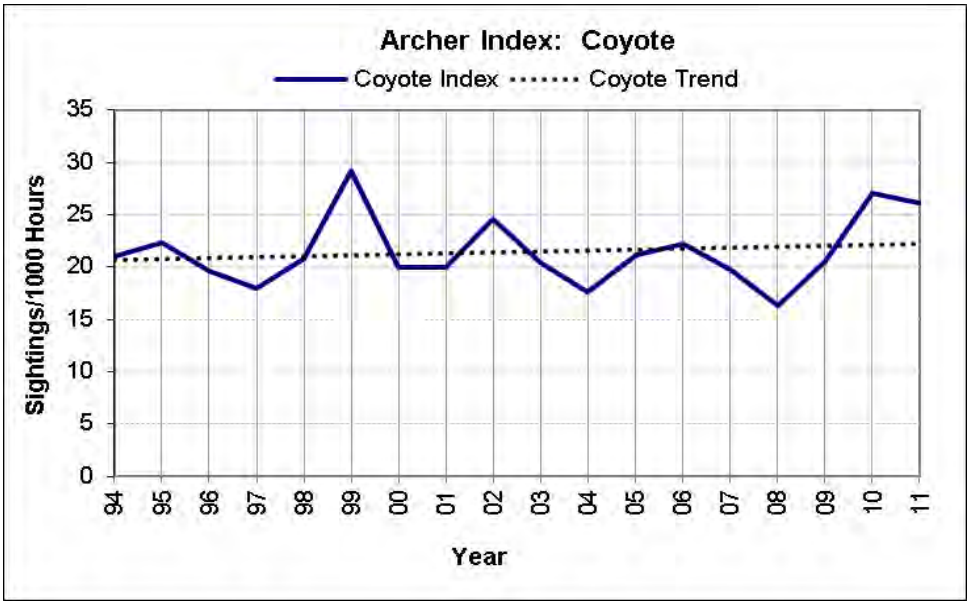


Figure 2. Coyote population trends based on our bowhunter observation survey.

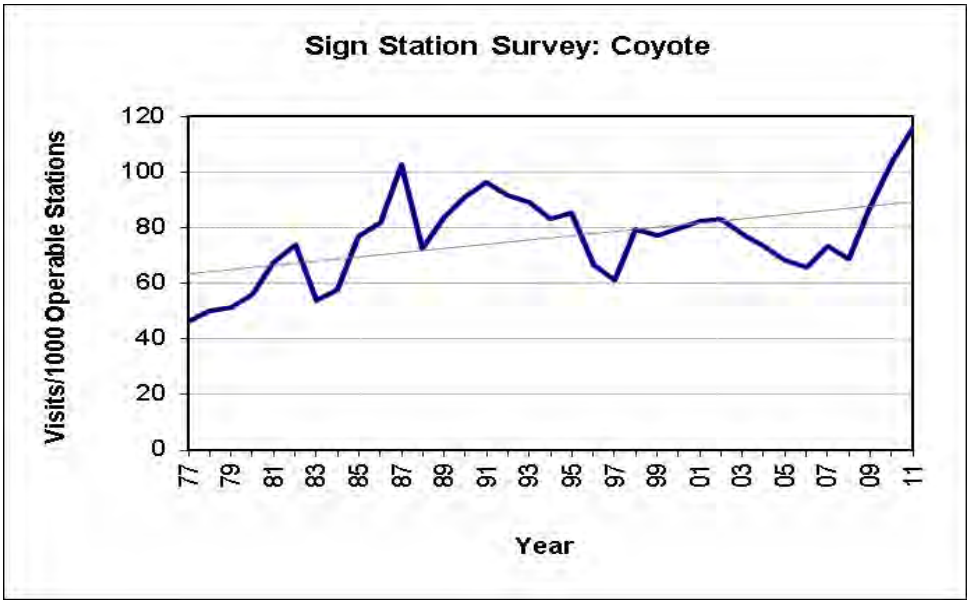


Figure 3. Coyote population trends based on sign station surveys.

FOX POPULATION AND HARVEST TRENDS

During the 2011-12 season, red fox harvest (1,191) increased 14.52% and gray fox harvest (757) increased 6.77% when compared with last year's harvest (Figures 1 and 2). Fox harvest is typically a by-product of bobcat or coyote trappers. Both the archer observations and sign station surveys suggest a continual decline in both red and gray fox populations (Figures 3 and 4). Fox declines may be the result of interspecific competition with coyotes and bobcats. A possible reason for the gray fox decline could be the increasing population of raccoons and their associated distemper virus; gray fox seem especially vulnerable to distemper virus.

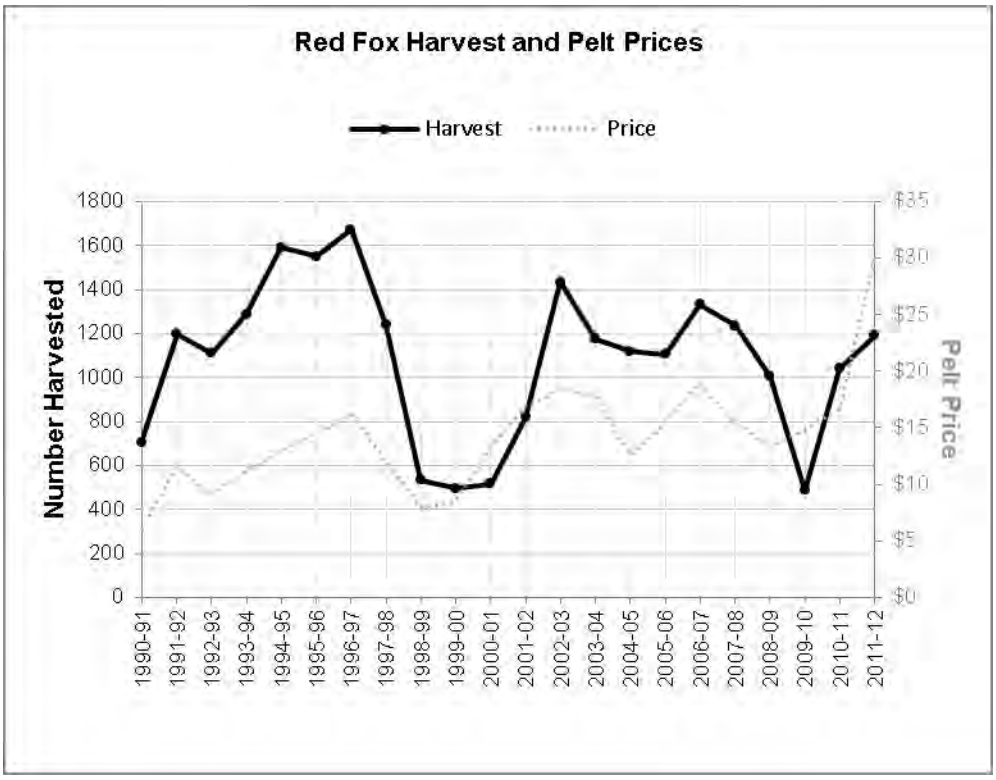


Figure 1. Comparison of red fox harvest and pelt prices over the last 22 years.

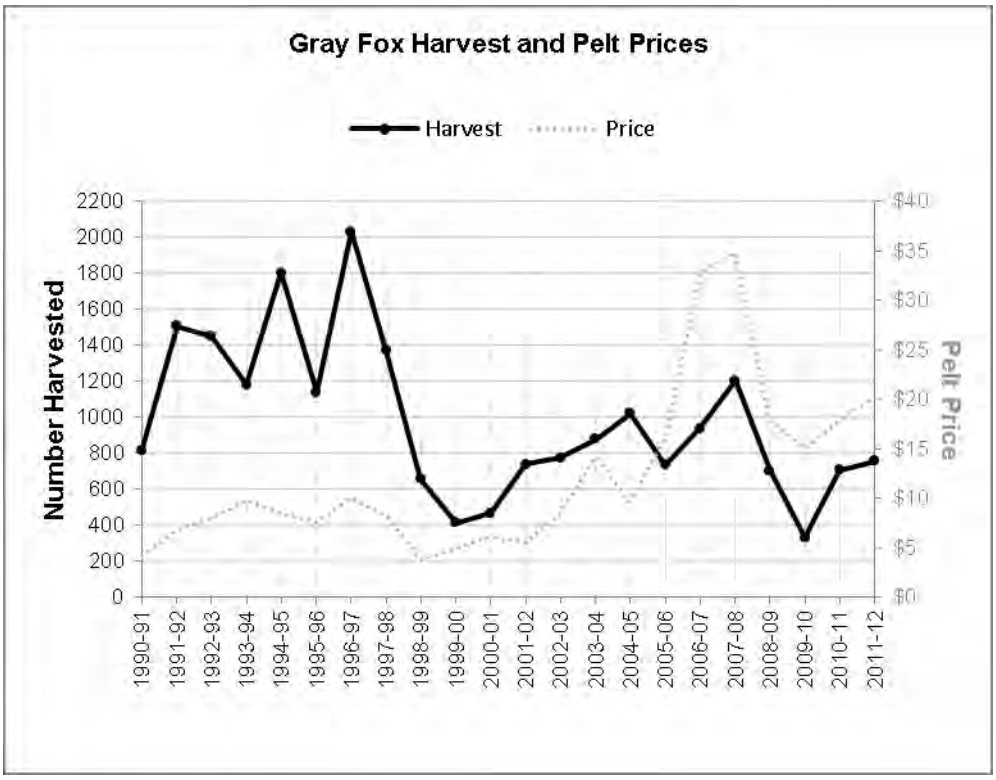


Figure 2. Comparison of gray fox harvest and pelt prices over the last 22 years.

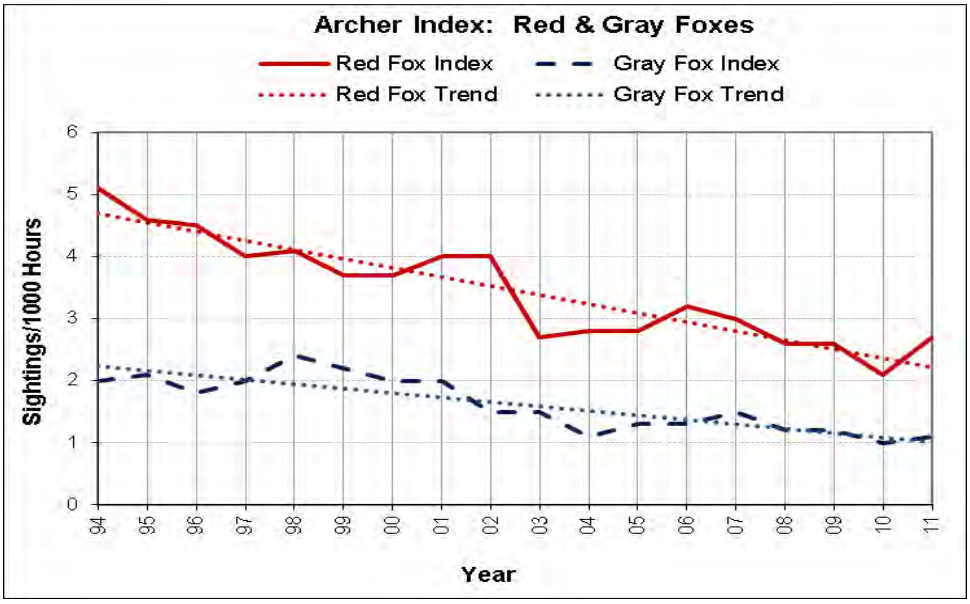


Figure 3. Fox population trends based on our bowhunter observation survey.

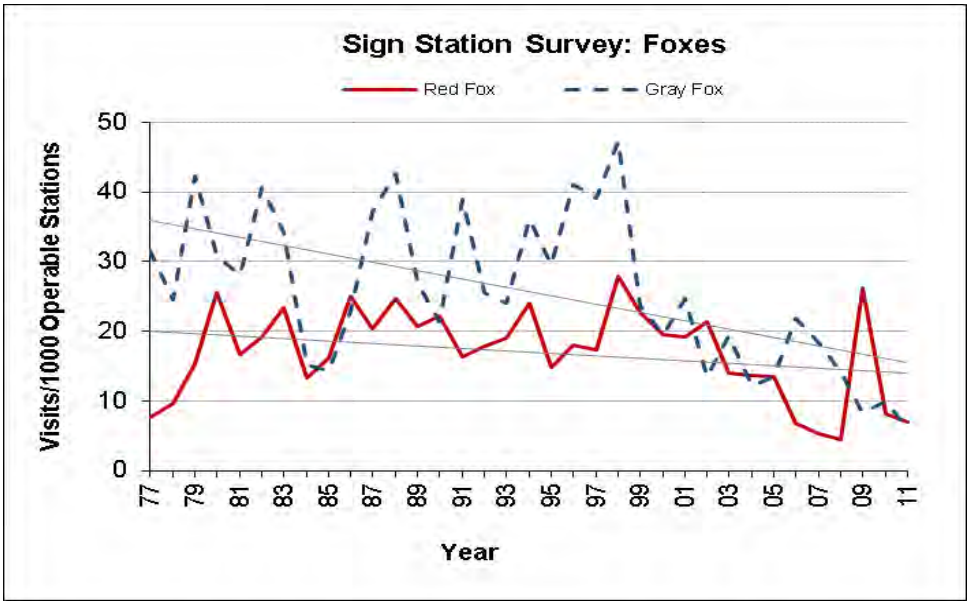


Figure 4. Fox population trends based on sign station surveys.

BOBCAT POPULATION AND HARVEST TRENDS

Trappers and hunters are required to check and seal bobcat carcasses or green pelts at MDC offices or with Conservation Agents. The data collected are used to monitor bobcat harvest in Missouri and to comply with CITES regulations.

The statewide harvest of bobcats during the 2011-12 was 4,199, up 8.00% from 2010-11 and 97.32% from 2009-10 (Figure 1). Bobcat harvest peaked during the 2006-07 season (4,453) when bobcat pelt prices averaged nearly $60 (Figure 2). Comparatively, average pelt price in 2010-11 was $45. During 2011-12 we had a significant increase in trappers and, although the mild weather may have reduced movements, the dry conditions were more favorable for land trapping.

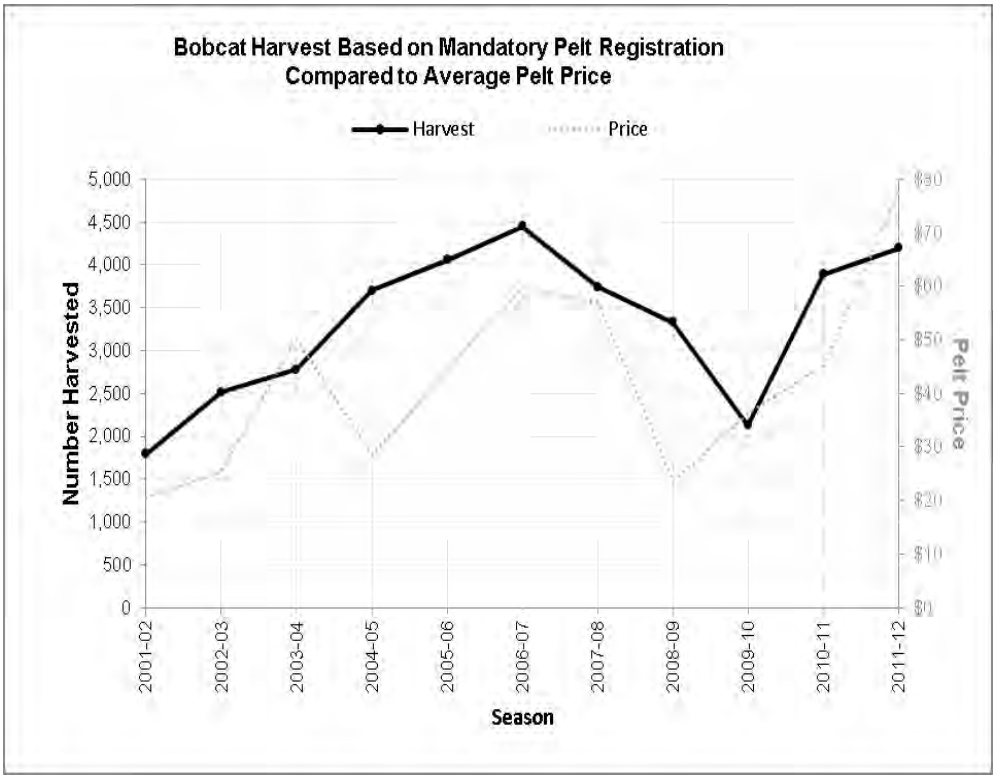


Figure 1. Bobcat harvest trends over the last 11 years compared to average pelt prices.

The number of bobcat pelts purchased by fur dealers (2,338) was significantly less than the number of bobcats checked by trappers as required by CITES (4,199). Instead of selling to fur buyers, trappers can make more money by selling carcasses to taxidermists or selling mounted bobcats on the internet. The significant drop in pelt sales to fur dealers is likely a reflection of this trend.

Archer Index data suggested an increase in bobcat sightings while sign station data suggest bobcat populations may have dipped some over the last couple years – the overall trend appears to be stable to slightly increasing (Figures 2 and 3). We saw no specific trend in regional harvests (Table 1, Figure 4) throughout the state. Bobcat harvest distribution suggests high harvest occurs early in the season, mostly from firearms deer hunters, and trapping harvest is later (Table 1, Section 2 page 4). Pelts are most prime after December.

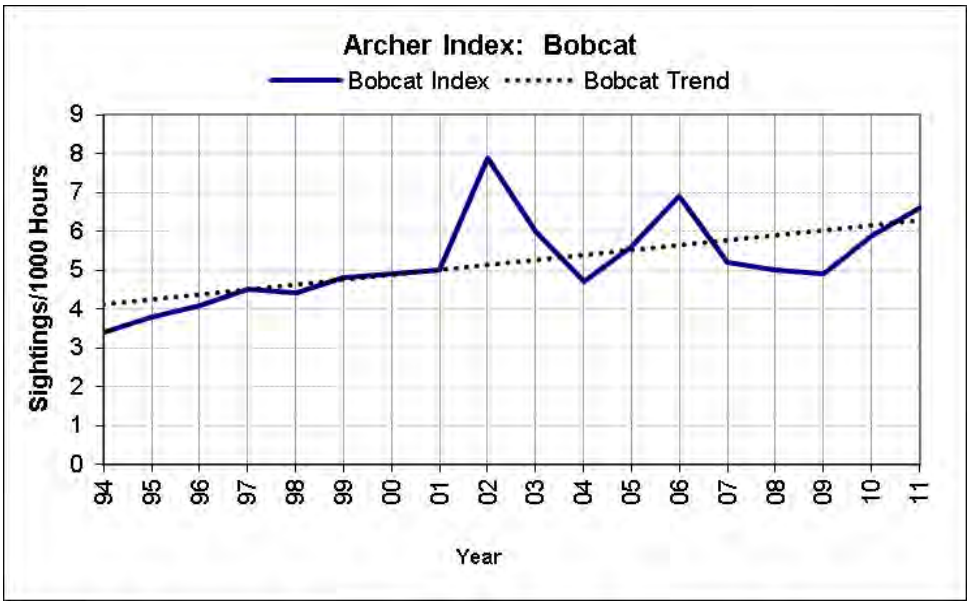


Figure 2. Bobcat population trends based on our bowhunter observation survey.

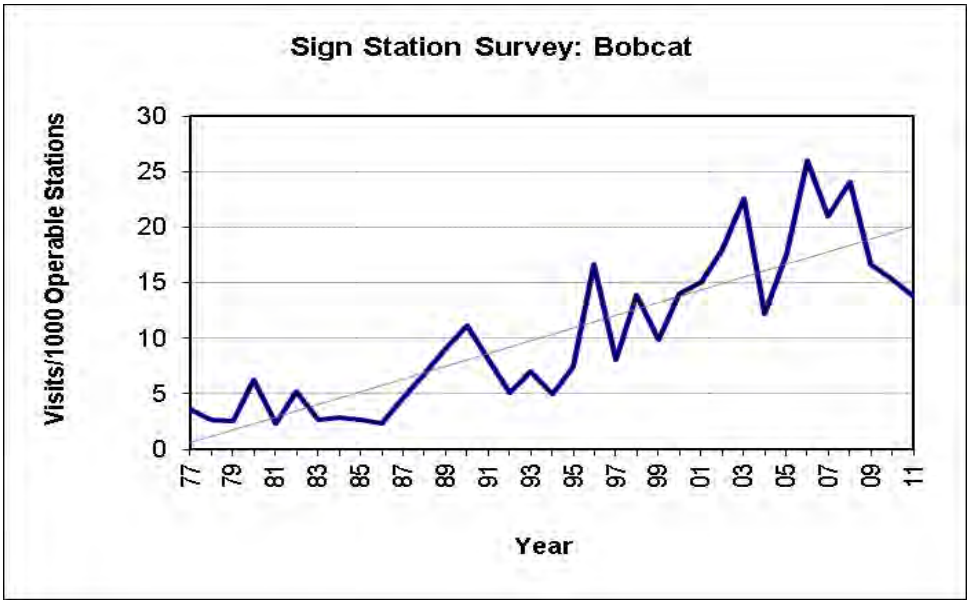


Figure 3. Bobcat population trends based on sign station surveys.

Table 1. Bobcat harvest (based on mandatory pelt registration) and pelt prices from 2001 – 2012, in Missouri, by zoogeographic regions.

	Bobcats Harvested per Season									
ZooRegion	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12
Northwest Prairie	470	347	410	470	493	358	341	150	342	391
Northern Riverbreaks	294	387	552	604	636	373	404	192	412	465
Northeast Riverbreaks	126	150	446	558	678	521	492	379	608	617
Western Prairie	497	605	624	616	763	572	446	235	542	694
Western Ozark Border	298	297	364	473	431	377	312	223	453	450
Ozark Plateau	487	648	881	852	918	984	868	550	962	1012
North and East Ozark Border	205	233	291	289	372	316	307	243	369	395
Mississippi Lowlands	113	116	133	208	158	159	157	154	185	165
Unknown	0	0	0	1	4	46	6	2	0	10
TOTAL	2,513	2,783	3,701	4,061	4,453	3,706	3,333	2,128	3,888	4,199
Bobcat Pelt Prices	$25.38	$50.15	$28.50	$44.53	$59.78	$56.93	$23.68	$36.30	$45.21	$77.66

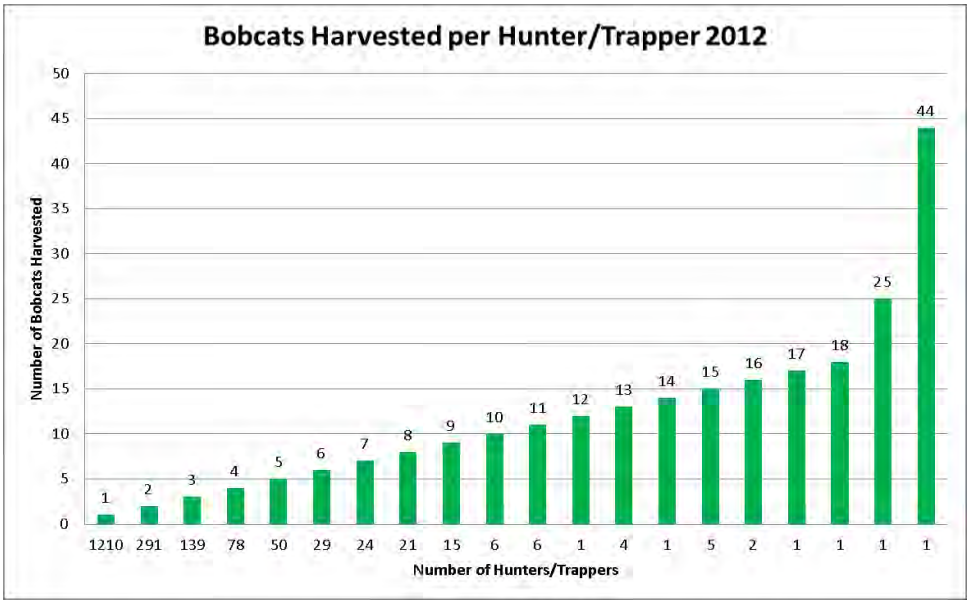


Figure 4. Number of bobcats harvested by individual hunter/trappers.

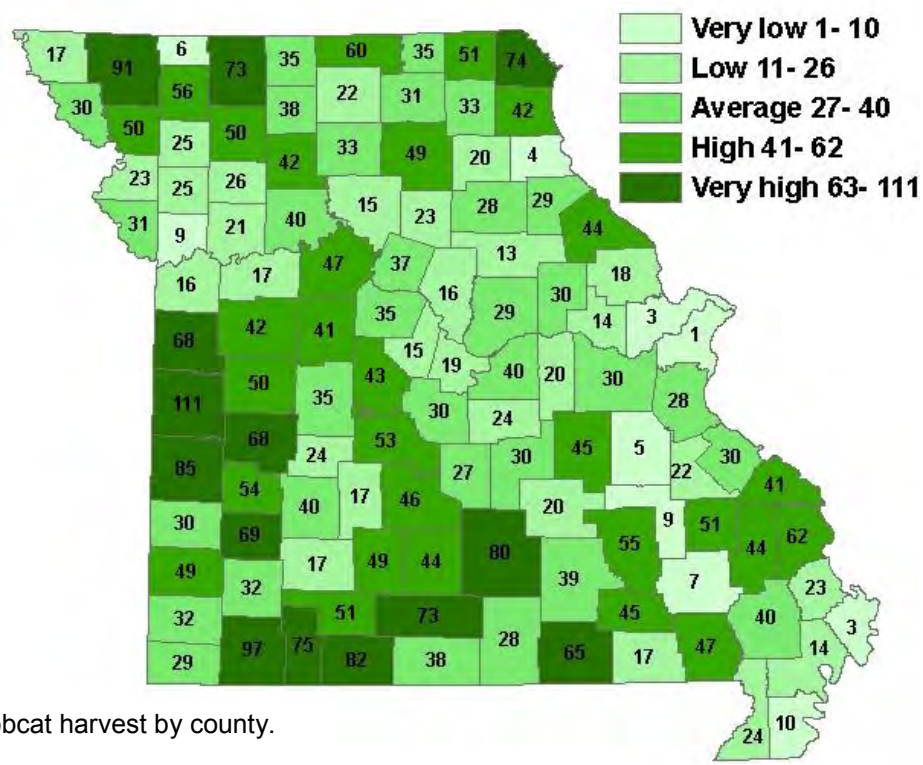


Figure 5. Bobcat harvest by county.

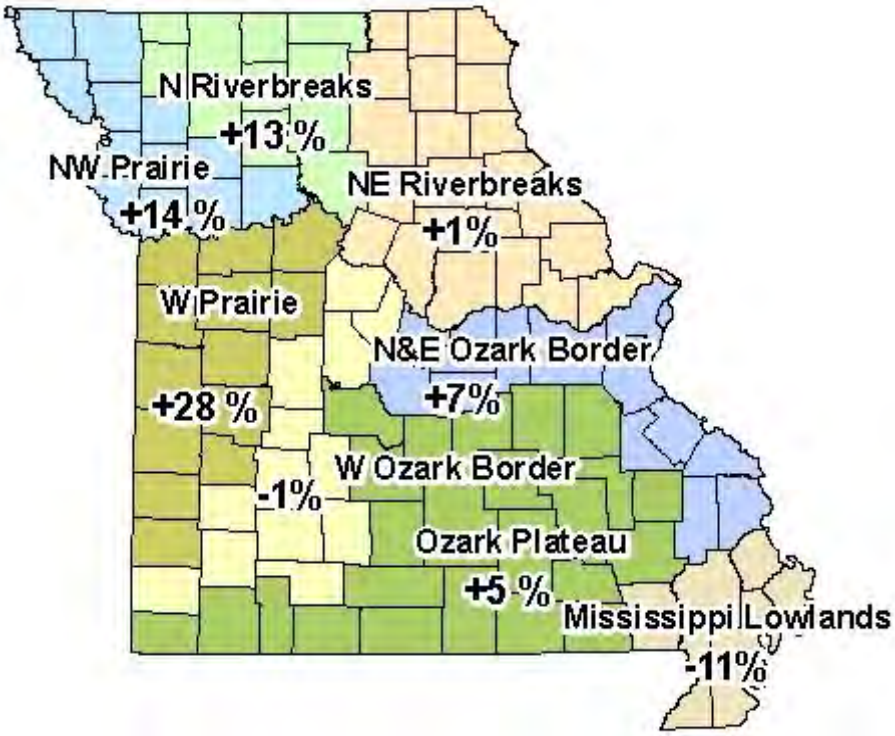


Figure 6. Comparison of bobcat harvest by zooregion between the 2010-11 and 2011-12 seasons.

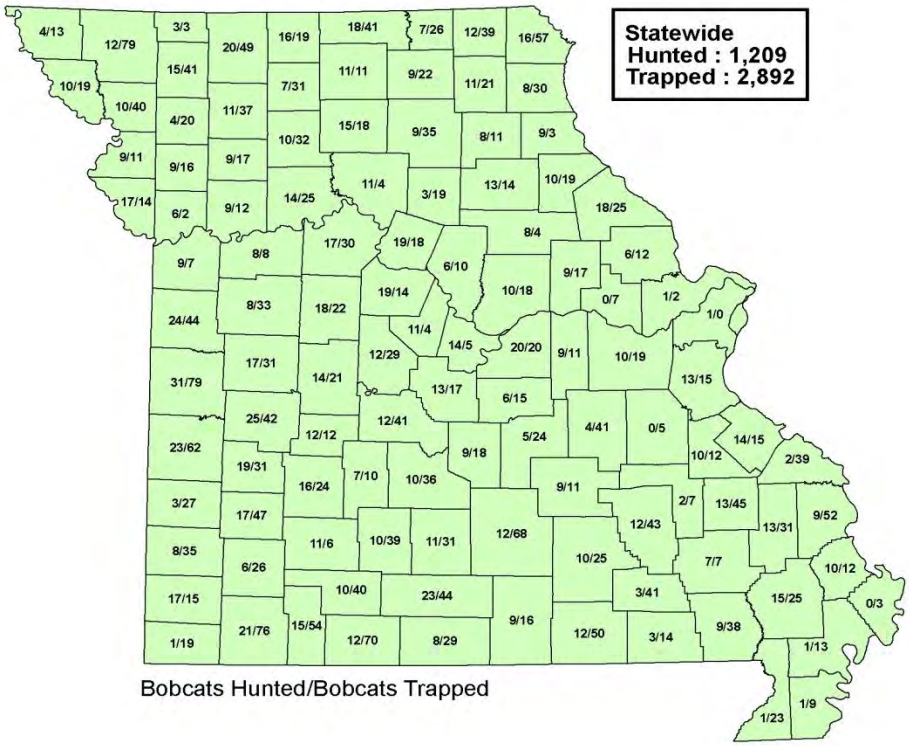


Figure 7. Comparison of hunted vs. trapped bobcats per county.


Photo courtesy of Danny Brown

OTTER POPULATION AND HARVEST TRENDS

Trappers are required to check and seal river otter carcasses or green hides at MDC offices or with Conservation Agents. The data collected are used to monitor statewide and regional otter harvest in Missouri and to comply with CITES regulations.

We had an all-time record harvest for otters with 4,233 animals harvested, which is a 64% increase over last year and a 265% increase over the last 2 years (Tables 1 and 2). Otter pelt prices have increased over the past couple years. The stable water conditions and pelt price are likely the reasons for increased harvest (Figure 1). Harvest date for otter and bobcat are available as a result of CITES tagging. Both species show a relatively long harvest season (Table 1).

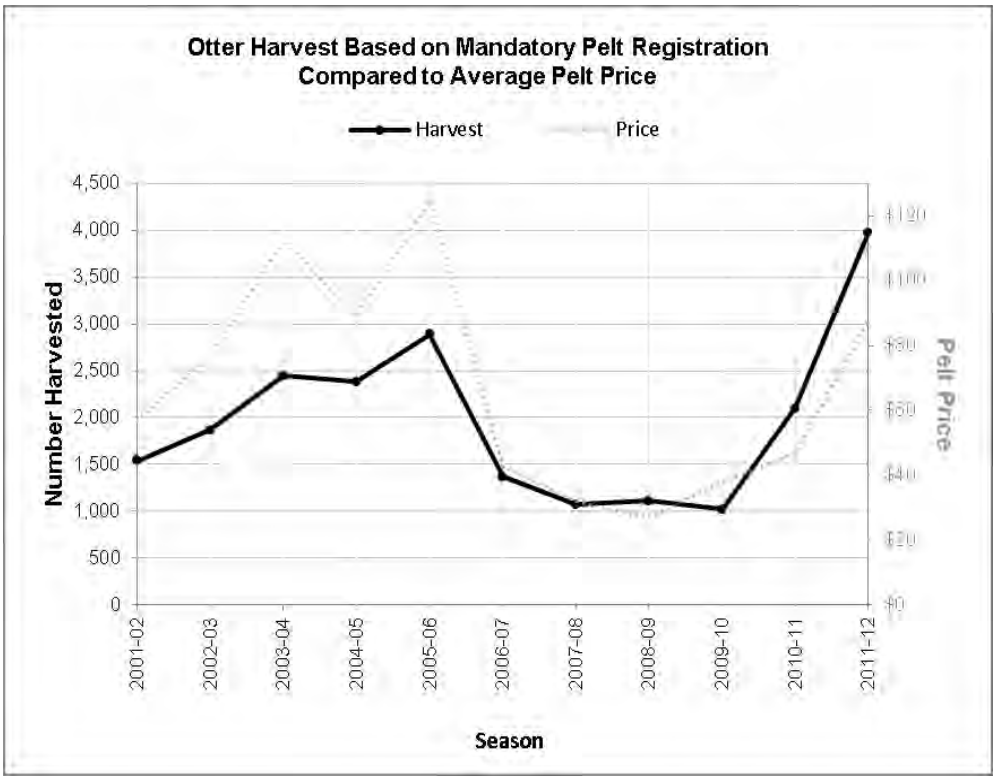


Figure 1. Otter harvest and pelt prices from 2001 – 2012.

Table 1. Bobcat and otter harvest during each week of the 2011-12 season.

Week of Season	Dates	Number of Bobcats Harvested	Number of Otters Harvested
---	Before Nov. 15	12	2
1	Nov.15 – 19	289	143
2	Nov. 20 – 26	345	289
3	Nov. 27 – Dec. 3	336	362
4	Dec. 4 – 10	275	326
5	Dec. 11 – 17	375	363
6	Dec. 18 – 24	340	313
7	Dec. 25 – 31	413	332
8	Jan. 1 – 7	492	363
9	Jan. 8 –14	437	359
10	Jan. 15 – 21	431	336
11	Jan. 22 – 28	237	223
12	Jan. 29 – Feb 4	66	119
13	Feb 5 – 11	---season closed---	249
14	Feb. 12 – 18	---season closed---	222
---	Feb 18-20	---season closed---	71
---	Unknown date	151	161
	TOTAL	4,199	4,233

Although most otter harvest occurs during December and January (Table 1), a longer season does facilitate targeted harvests. From a county basis otter harvest was highest in Chariton and Pike counties with harvests of 160 and 130 respectively (Figure 2). Other high harvest counties were in the west-central and north-central regions of Missouri.

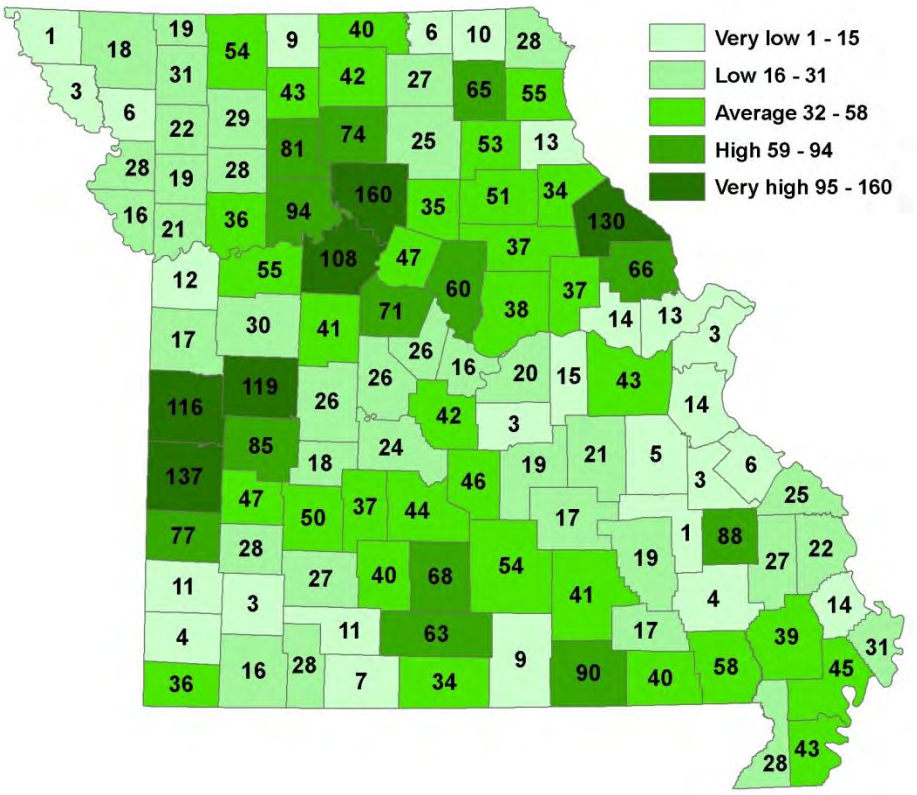


Figure 2. The number of otters harvested by county during the 2011-12 season.

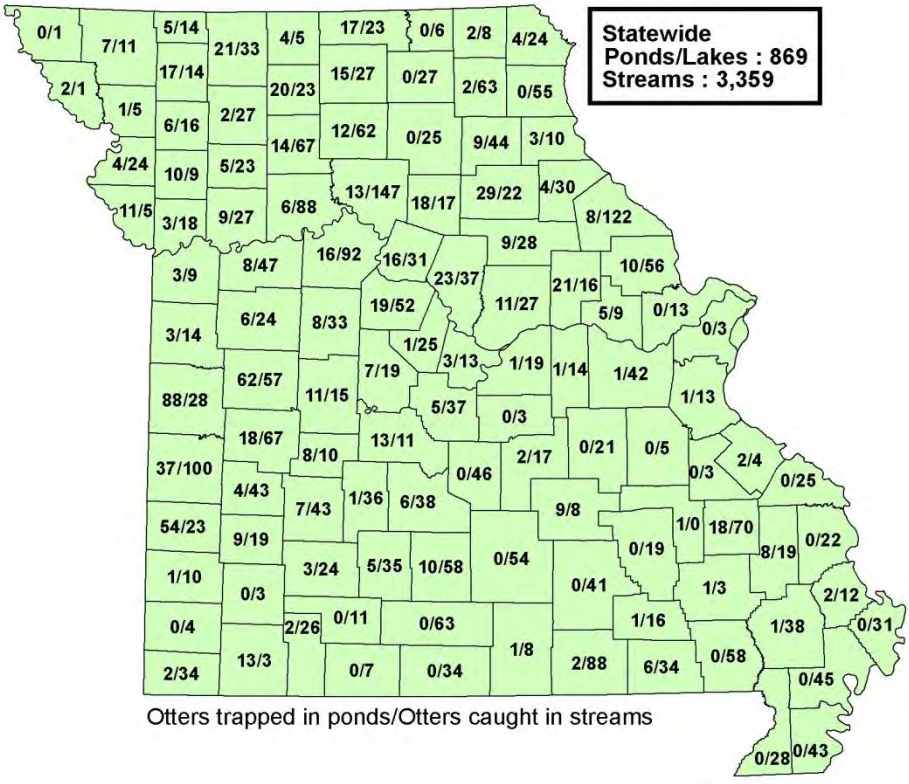


Figure 3. Comparison of otters trapped in ponds vs. streams.

Otter harvest during the 2011-12 season was highest in the Missouri River, Grand River and Osage River watersheds (Figure 4, Table 2). Twenty-five% (1,204) of the total otters harvested were in these three watersheds. Other watersheds with high harvest included the Gasconade, Chariton and Salt.

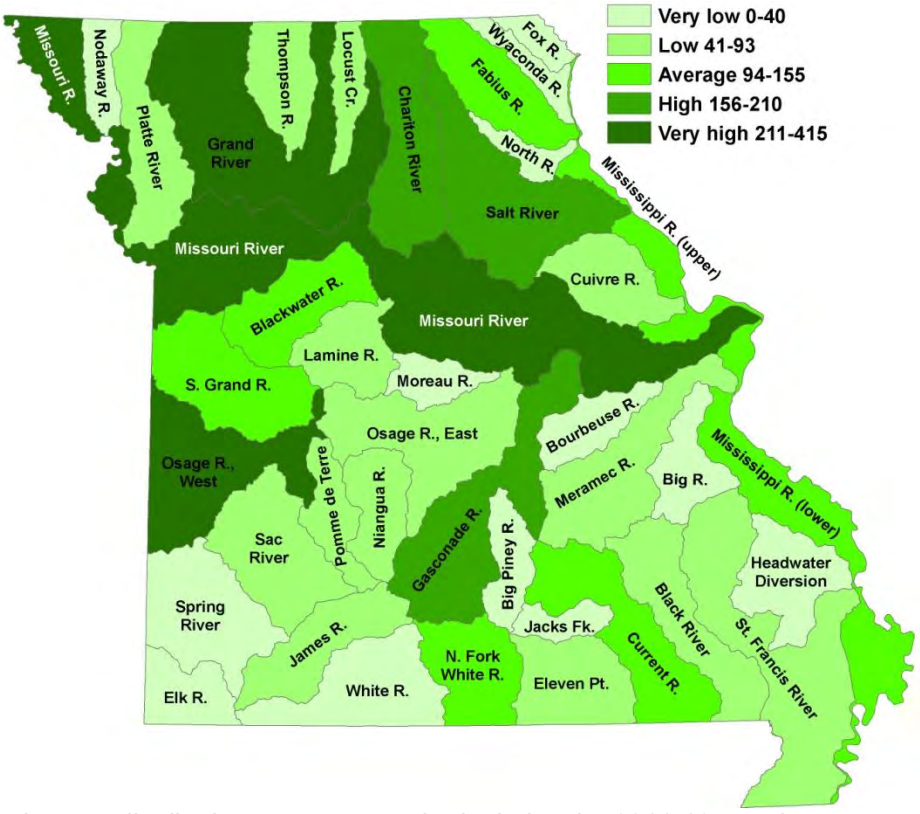


Figure 4. Otter harvest distribution among watersheds during the 2011-12 trapping season.

Table 2. Otter harvest distribution among watersheds during the 2011-12 trapping season.

Watershed	Number Harvested	Percent of Harvest
Big Piney River	44	1.04%
Big River	2	0.05%
Black River	77	1.82%
Blackwater River	109	2.58%
Bourbeuse River	11	0.26%
Chariton River	183	4.33%
Cuivre River	71	1.68%
Current River	104	2.46%
Eleven Point River	83	1.96%
Elk River	28	0.66%
Fabius River	119	2.82%
Fox River	13	0.31%
Gasconade River	205	4.85%
Grand River	388	9.18%
Headwater Diversion	32	0.76%
Jacks Fork River	21	0.50%
James River	64	1.51%
Lamine River	64	1.51%
Locust Creek	60	1.42%
Meramec River	49	1.16%
Mississippi R. (lower)	155	3.67%

Watershed	Number Harvested	Percent of Harvest
Mississippi R. (upper)	148	3.50%
Missouri River	415	9.82%
Moreau River	40	0.95%
N. Fork White River	112	2.65%
Niangua River	58	1.37%
Nodaway River	8	0.19%
North River	10	0.24%
Osage River East	59	1.40%
Osage River West	401	9.49%
Platte River	63	1.49%
Pomme de Terre River	93	2.20%
S. Grand River	128	3.03%
Sac River	75	1.78%
Salt River	210	4.97%
Spring River	29	0.69%
St. Francis River	84	1.99%
Thompson River	43	1.02%
White River	20	0.47%
Wyaconda River	1	0.02%
Unknown	346	8.19%
TOTAL HARVEST	4233	100%

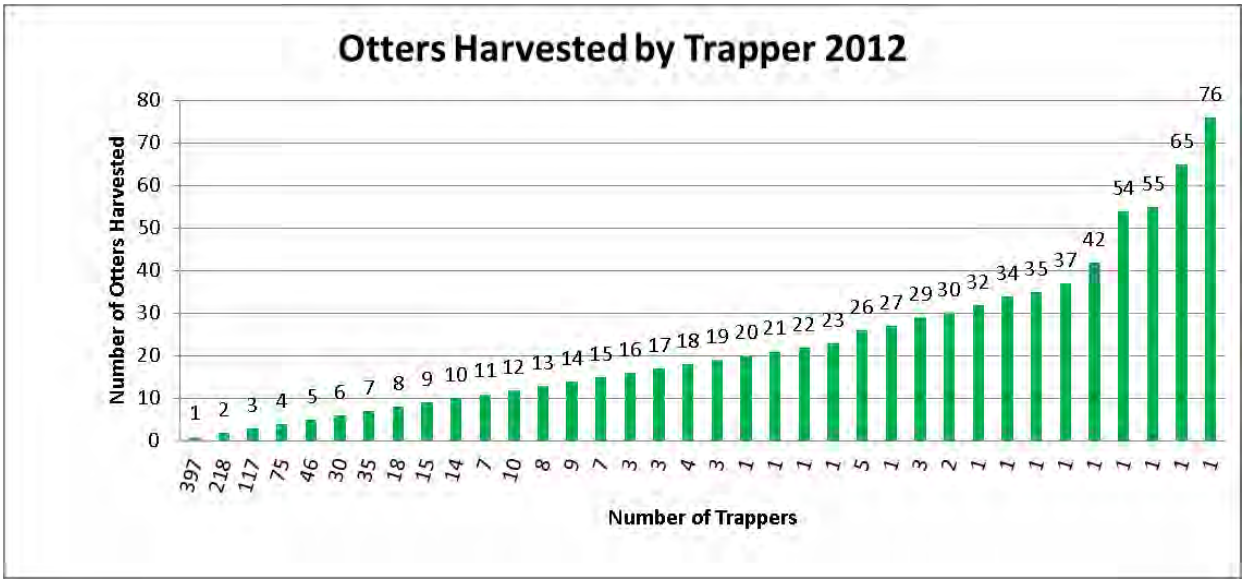


Figure 5. Number of otters harvested by individual trappers.

SECTION 2:
Research projects and monitoring efforts

FURBEARER SIGN STATION SURVEY

SUMMARY OF 2011 FURBEARER SIGN STATION SURVEY

Background

The furbearer sign station survey occurs annually in September. The survey dates back to 1977 and gathers furbearer population trend information across the state. Currently there are twenty-five routes, each in a different county. Each route is broken into five segments with 10 sign stations each, for a total of 50 sign stations per route. Sign stations are 36-inch diameter circles of sifted soil set up every 0.3 miles along shoulders of gravel roads. In the middle of each station is a scent disc infused with a fatty acid scent attractant. Stations are set up in a day and checked the next day for presence of animal tracks.

When checking the stations, observers note whether or not stations are operable. If a station has been destroyed by a road grader or other vehicle, the station is deemed inoperable and not included in index calculations. If a station is operable, it is included in the calculation of indices regardless of the presence of tracks. Observers identify any tracks within the station but do not count the number of animals of any species visiting a station.

Results

In 2011, 21 of 25 routes (Figure 1) were completed with a total of 1,011 operable stations out of a possible 1,100. A breakdown of operable stations per zooregion is shown in Table 1. Inoperable stations were due to tire tracks and road graders.

Table 1. Summary of operable and inoperable sign stations in 2011 by zooregion.

Zooregion	Number of routes completed	Number of operable stations	Number of inoperable stations
Northwest Prairie	2	100	0
Northern Riverbreaks	3	135	15
Northeast Riverbreaks	4	195	5
Western Prairie	2	97	3
Western Ozark Border	3	145	5
Ozark Plateau	4	192	8
North & East Ozark Border	3	147	3
Mississippi Lowlands	0	0	0
TOTAL	21	1011	89

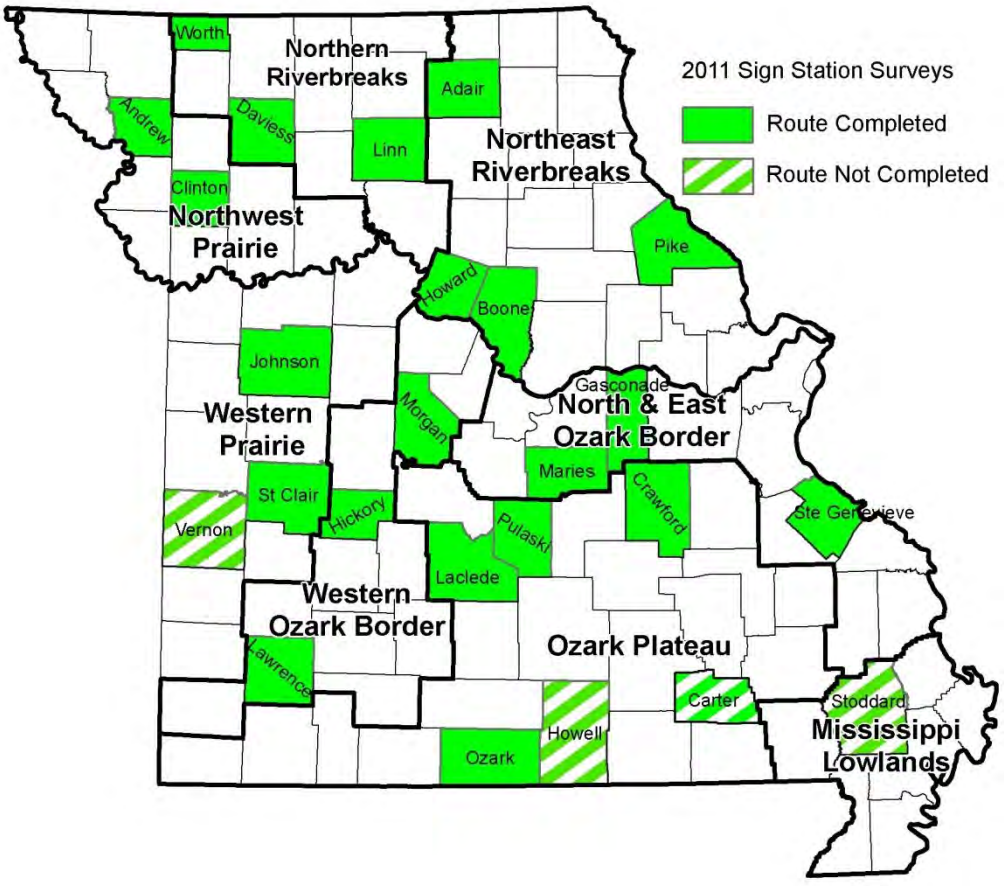


Figure 1. Map of Missouri showing counties with sign station routes within their respective zooregion.

The most common furbearer species to visit sign stations include raccoon, opossum and coyote (Figure 2). Less common visitors include bobcat, fox, mink and weasel. Birds such as sparrows, turkeys and quail are also attracted to the freshly sifted soil of the sign stations. Figures 3 through 6 show furbearer

population trends based on sign station survey data from 1977-2011. Overall, trends indicate most furbearer species have steady to slightly increasing populations. Red and gray fox populations have declined, which is also reflected in bowhunter observations and harvest records.

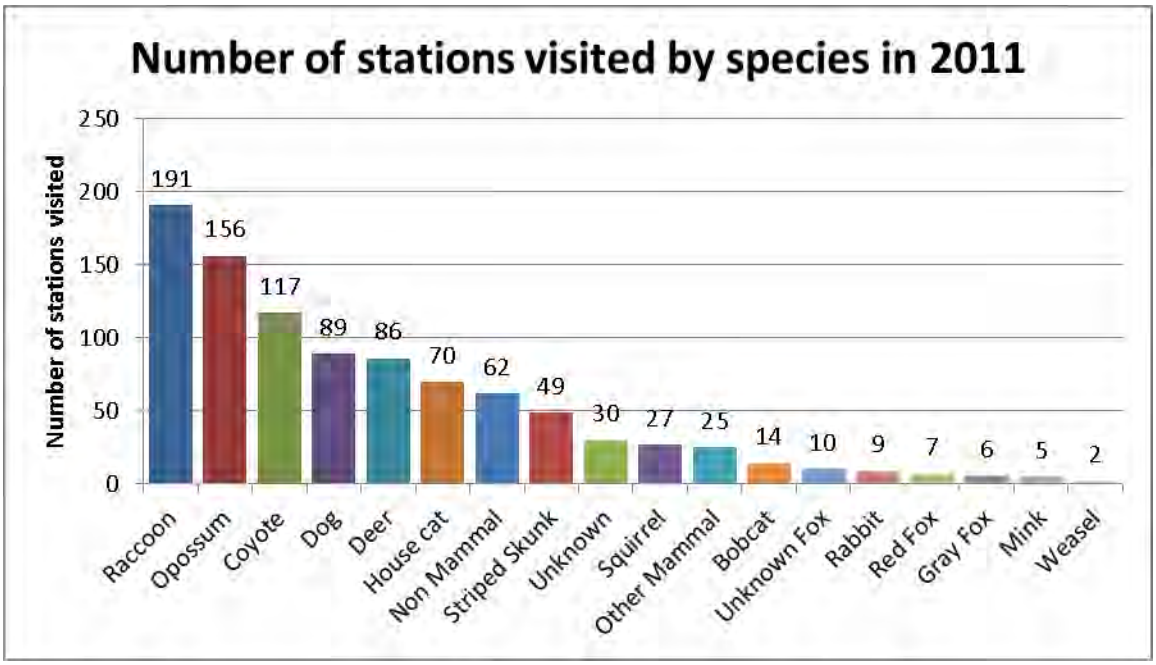


Figure 2. The number of stations visited by mammal species (including non-furbearers) out of 1,011 operable stations in the 2011 survey.

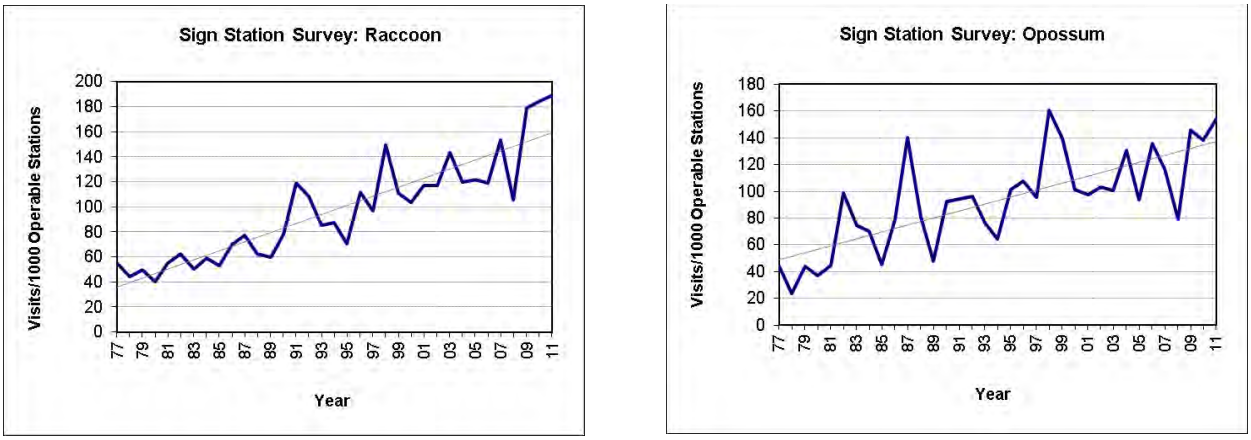


Figure 3. Raccoon and opossum population trends based on annual furbearer sign station survey.

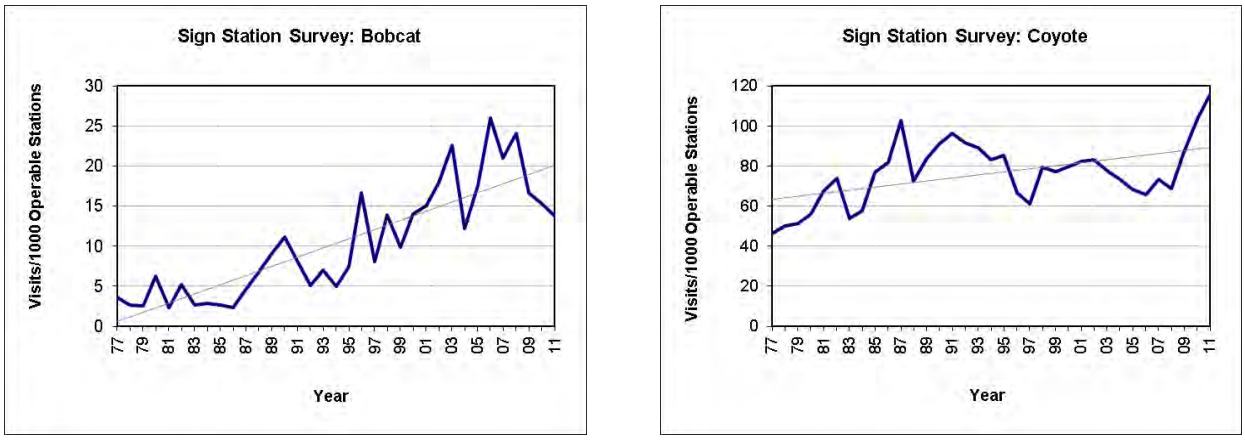


Figure 4. Bobcat and coyote population trends based on annual furbearer sign station survey.

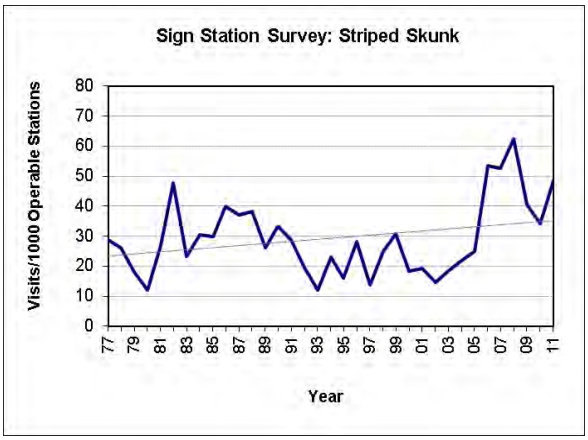


Figure 5. Skunk population trend based on annual furbearer sign station survey.

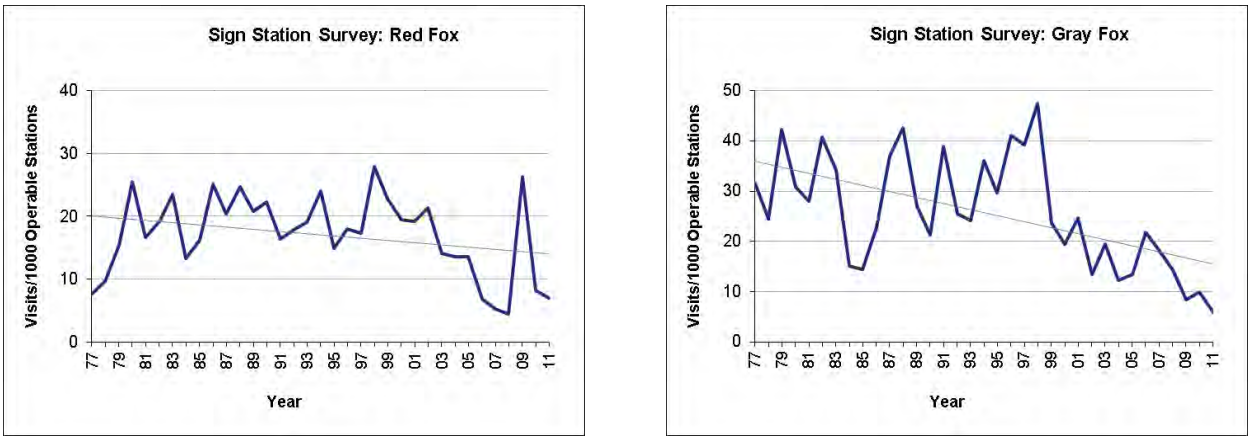


Figure 6. Red and gray fox population trends based on annual furbearer sign station survey.

ARCHER'S INDEX TO FURBEARER POPULATIONS

MONITORING FURBEARER TRENDS USING DATA GATHERED FROM COOPERATOR BOWHUNTERS

Introduction

For 29 consecutive years (1983-2011), we have conducted annual surveys of wildlife populations via the archer's diary survey. Each fall, several thousand archery deer and turkey hunters keep daily observation records for furbearers, other small game animals, deer and turkeys. Archers volunteer through post-season surveys, articles in the *Missouri Conservationist* magazine, and during sign-ups at bowhunter club meetings and other outdoor events. Archery hunters are asked to record the number of hours hunted, during both morning and evening hunts, and to use a standardized daily diary to record hours and sightings of wildlife. We use the number of sightings of each species divided by the total number of hours hunted statewide to calculate a sighting rate, and this is then expressed as the number of sightings per 1,000 hunter hours to calculate population indices.

Wildlife population indices calculated from archer's diaries are useful trend indicators for terrestrial wildlife such as squirrels, white-tailed deer, turkeys, coyotes, raccoons, foxes and bobcats. Hunters are well distributed statewide, with volunteers in 112 of the 114 counties during most years. Hunters averaged 52,781 hours over the last 28 years, and they ranged from a low of 30,990 in 1985 and a high of 84,497 in 1988 (Table 1).

Table 1. Hunter hours and furbearer population indices based on archer's diaries, 1983-2011.

Years	Hunter Hours	Coyote	Red Fox	Gray Fox	Bobcat	Raccoon	Opossum	Striped Skunk	Mink	Beaver	Muskrat	Weasel	Badger	Otter	Black Bear
1983	55,374	20.0	6.5	5.1	1.7	23.8	12.6	5.0	0.7	0.3	0.5	0.1	0.1	0.0	0.0
1984	32,746	18.8	6.8	3.1	1.2	16.9	6.4	3.5	0.3	0.3	0.1	0.0	0.1	0.0	0.0
1985	30,990	20.1	5.3	2.8	1.5	15.4	8.6	4.2	0.5	0.4	0.4	0.1	0.1	0.1	0.0
1986	51,727	23.5	5.7	2.8	1.5	15.3	6.9	3.5	0.3	0.4	0.0	0.0	0.0	0.0	0.0
1987	57,457	23.5	4.5	2.5	2.0	23.3	10.1	3.0	0.3	0.7	0.2	0.1	0.1	0.1	0.0
1988	84,497	22.4	4.7	2.4	1.7	16.7	4.8	2.7	0.3	0.6	0.1	0.0	0.1	0.1	0.0
1989	72,992	21.1	5.1	2.4	1.8	19.6	5.6	3.5	0.1	0.6	0.1	0.0	0.2	0.1	0.0
1990	72,227	23.6	4.9	2.3	2.9	24.0	7.2	3.5	0.2	0.4	0.1	0.0	0.1	0.1	0.0
1991	64,434	26.1	4.7	3.0	3.3	30.5	11.7	4.0	0.3	0.3	0.1	0.0	0.1	0.0	0.1
1992	64,452	22.5	4.7	2.3	2.9	24.3	8.9	2.8	0.6	0.7	0.1	0.0	0.1	0.3	0.0
1993	53,857	19.7	4.2	2.1	3.2	28.1	7.7	3.7	0.2	0.5	0.2	0.0	0.1	0.3	0.0
1994	49,102	21.0	5.1	2.0	3.4	32.0	7.6	3.2	0.1	0.5	0.2	0.0	0.2	0.2	0.0
1995	66,106	22.3	4.6	2.1	3.8	36.5	9.6	3.6	0.1	0.3	0.1	0.0	0.1	0.3	0.1

YEAR	Hunter Hours	Coyote	Red Fox	Gray Fox	Bobcat	Raccoon	Opossum	Striped Skunk	Mink	Beaver	Muskrat	Weasel	Badger	Otter	Black Bear
1996	60,077	19.6	4.5	1.8	4.1	29.7	6.6	2.7	0.0	0.3	0.0	0.0	0.1	0.5	0.0
1997	47,816	18.0	4.0	2.0	4.5	31.2	7.4	2.7	0.1	0.4	0.0	0.0	0.1	0.6	0.0
1998	43,152	20.8	4.1	2.4	4.4	33.0	10.6	4.2	0.1	0.3	0.1	0.0	0.2	0.3	0.1
1999	44,012	29.2	3.7	2.2	4.8	45.9	12.5	4.0	0.2	0.3	0.1	-	0.1	0.5	-
2000	50,795	20.0	3.7	2.0	4.9	32.1	8.1	3.3	0.0	0.2	0.0	0.0	0.1	0.3	0.0
2001	47,023	19.5	3.6	2.1	5.2	38.7	8.2	4.7	0.1	0.4	0.0	0.0	0.1	0.3	0.0
2002	42,826	24.6	3.8	1.5	7.9	42.6	14.4	5.6	0.3	0.1	0.0	0.0	0.1	0.8	0.1
2003	39,964	20.5	2.7	1.5	6.0	37.9	7.2	3.2	0.1	0.1	0.0	0.0	0.2	0.6	0.0
2004	35,071	17.6	2.8	1.1	4.7	37.3	7.9	2.6	0.1	0.1	0.1	0.0	0.1	1.2	0.0
2005	68,440	21.2	2.8	1.3	5.6	37.3	8.5	2.5	0.1	0.3	0.0	0.0	0.1	0.5	0.0
2006	60,040	22.2	3.2	1.3	6.9	54.4	14.4	3.8	0.3	0.2	0.0	0.0	0.1	0.5	0.0
2007	50,390	19.8	3.0	1.5	5.2	40.0	9.4	4.0	0.0	0.1	0.0	0.0	0.1	0.4	0.0
2008	44,471	16.3	2.6	1.2	5.0	41.5	7.8	3.7	0.1	0.1	0.1	0.0	0.4	0.3	0.0
2009	44,919	20.6	2.6	1.2	4.9	42.0	12.4	4.4	0.1	0.1	0.1	0.0	0.2	1.2	0.1
2010	42,907	27.1	2.1	1.0	5.9	60.6	12.9	3.1	0.2	0.1	0.0	0.0	0.2	0.7	0.0
2011	41,370	26.1	2.7	1.1	6.6	70.1	16.6	4.6	0.2	0.1	0.1	0.0	0.2	0.9	0.1

Line graph representations of archer indices for several furbearer species are shown in Figure 1. Based on these indices, raccoon, bobcat and opossum populations show a steady rise. Striped skunk and coyote populations are holding relatively steady, while graphs indicate a downward trend for red and gray fox populations. Wildlife population indices are also depicted by county (Table 2).

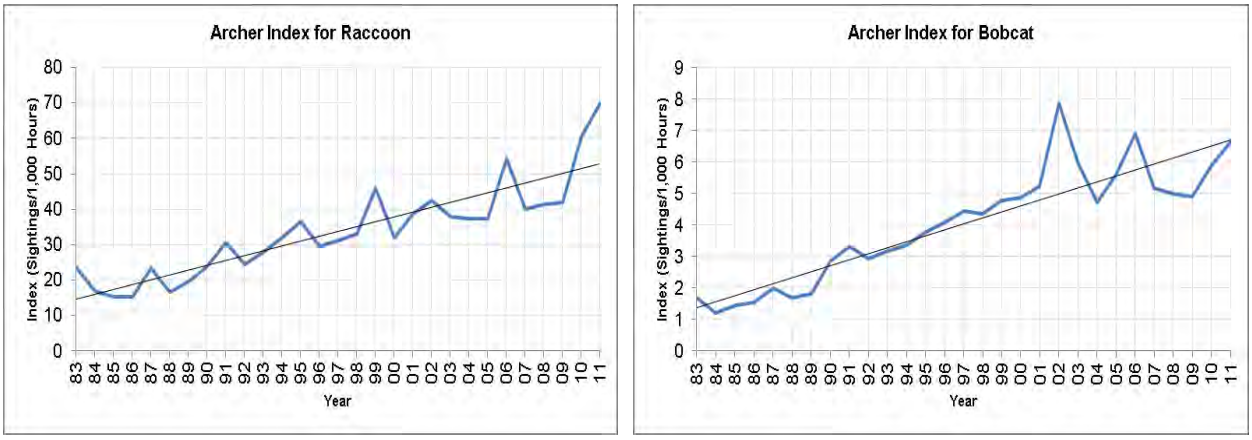


Figure 1. Population trends of some furbearing species based on archer observations.

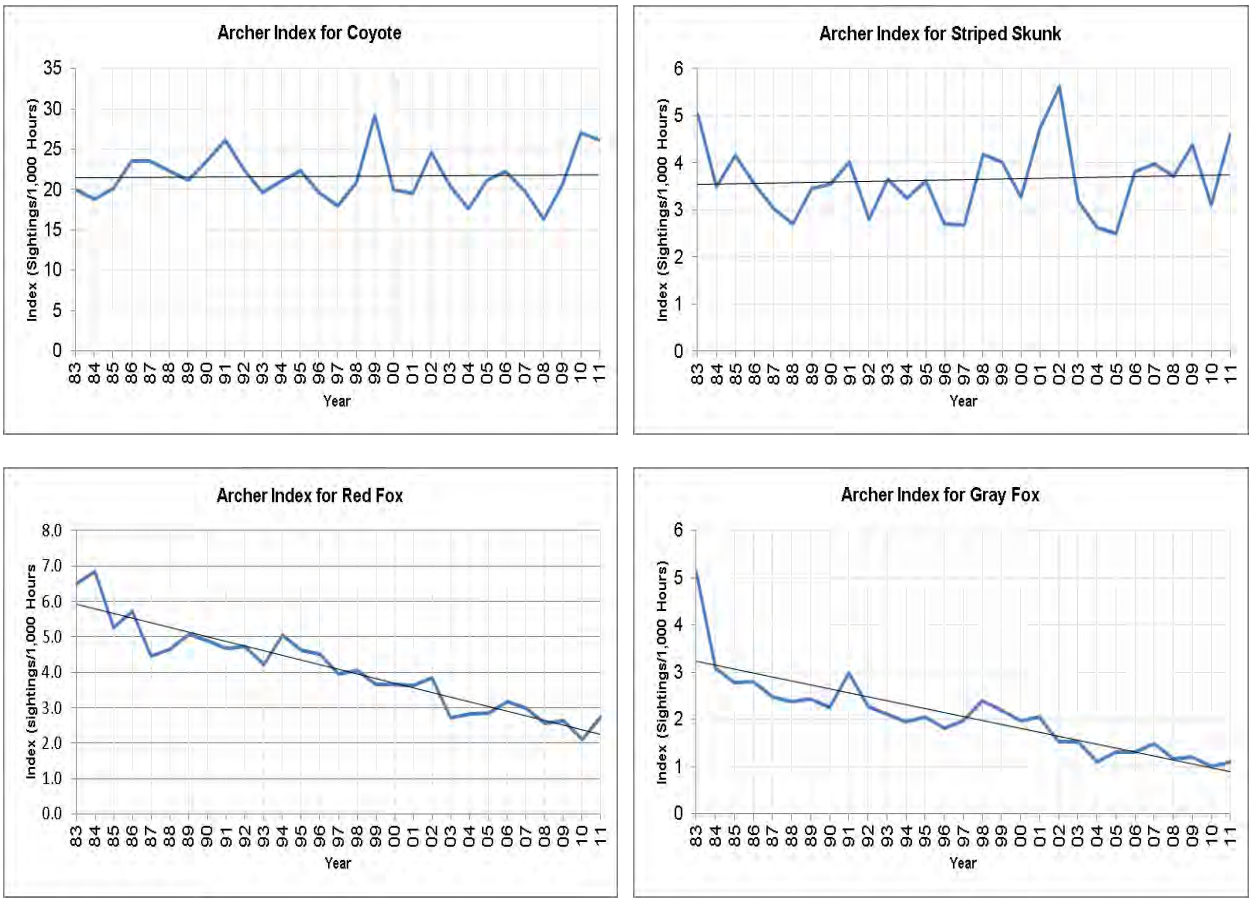


Figure 1 (continued). Population trends of some furbearing species based on archer indices.

Table 2. County wildlife Indices for 2011 based on sightings by cooperator archery hunters (sightings/1,000 hours).

County	Coyote	Deer	Turkey	Raccoon	Opossum	Red Fox	Gray Fox	Bobcat	Badger	Bear
Adair	19	973	369	84	10	0	0	5	0	0
Andrew	4	178	199	23	15	0	0	1	0	0
Atchison	9	78	54	8	0	0	0	0	0	0
Audrain	13	352	189	57	6	2	0	0	1	0
Barry	3	151	31	9	1	2	0	3	0	0
Barton	26	647	170	72	17	0	0	3	0	0
Bates	35	175	131	31	10	0	0	5	0	0
Benton	7	554	274	27	5	0	0	9	0	0
Bollinger	8	335	149	10	4	0	0	5	0	0
Boone	16	488	146	37	7	1	0	1	0	0
Buchanan	3	73	22	18	0	0	0	0	0	0
Butler	0	36	8	0	0	0	0	0	0	0
Caldwell	4	49	37	3	1	0	0	2	0	0
Callaway	12	311	128	14	5	6	1	2	0	0
Camden	5	255	101	1	2	2	0	1	0	0

Cape Girardeau	4	426	143	12	2	0	0	2	0	0
Carroll	21	371	121	134	31	0	0	8	0	0
Carter	1	249	16	0	0	0	0	0	0	0
Cass	12	93	99	2	1	3	0	0	0	0
Cedar	8	540	275	20	7	3	0	3	0	0
Chariton	8	369	33	57	8	0	0	1	1	0
Christain	4	174	71	4	0	1	0	1	0	0
Clark	3	211	20	17	5	0	0	1	0	0
Clay	3	307	156	30	10	0	0	0	0	0
Clinton	10	270	112	45	2	0	0	0	0	0
Cole	8	133	103	9	2	0	0	0	0	0
Cooper	25	645	141	63	7	0	0	8	0	0
Crawford	8	261	310	15	9	4	0	7	0	0
Dade	2	201	65	4	1	0	0	2	0	0
Dallas	4	72	121	2	1	0	2	0	0	0
Davies	10	308	193	61	17	0	0	1	0	0
Dekalb	14	323	235	23	5	0	1	3	1	0
Dent	3	278	150	0	1	1	1	1	0	0
Douglas	4	115	166	7	0	1	0	1	0	0
Dunklin	0	13	8	1	0	0	0	0	0	0
Franklin	6	361	214	13	4	3	0	1	0	0
Gasconade	12	328	339	14	6	0	1	1	0	0
Gentry	10	189	38	18	2	0	0	0	1	0
Greene	3	260	359	11	1	1	1	1	0	0
Grundy	0	9	0	10	0	0	0	0	0	0
Harrison	7	83	27	10	2	0	0	2	0	0
Henry	21	622	450	77	14	0	0	8	0	0
Hickory	10	323	210	7	1	0	0	2	0	0
Holt	4	109	170	0	0	0	0	0	0	0
Howard	9	487	469	54	12	1	0	5	0	0
Howell	10	212	74	3	0	0	0	3	0	0
Iron	0	3	8	0	0	0	0	0	0	0
Jackson	10	555	114	45	10	13	0	1	0	0
Jasper	6	517	537	35	23	1	0	2	0	0
Jefferson	10	500	262	16	11	7	0	0	0	0
Johnson	2	340	75	24	10	0	0	7	0	0
Knox	11	729	501	64	17	2	4	2	0	0
Laclede	2	118	112	5	4	0	0	1	0	0
Lafayette	7	101	66	32	1	1	1	0	0	0
Lawrence	9	111	63	0	2	2	0	0	0	0
Lewis	23	418	122	74	5	2	0	2	1	0
Lincoln	20	476	228	34	7	1	1	7	0	0
Linn	16	1017	487	66	10	0	0	5	0	0
Livingston	8	232	33	23	4	1	0	1	0	0
Mcdonald	0	120	0	0	0	0	0	1	0	0
Macon	15	690	569	93	26	0	7	6	0	0
Madison	2	120	212	4	0	1	0	3	0	0
Maries	2	157	141	2	4	0	0	0	0	0

Marion	20	687	250	55	14	4	1	6	0	0
Mercer	9	600	463	53	21	0	0	1	1	0
Miller	4	147	129	3	1	0	0	0	0	0
Mississippi	0	4	7	0	0	0	0	0	0	0
Moniteau	1	105	130	26	3	0	0	0	0	0
Monroe	26	523	696	107	24	3	0	1	0	0
Montgomery	10	215	182	18	5	0	2	5	1	0
Morgan	1	327	23	3	2	2	0	3	0	0
New Madrid	1	2	0	0	0	0	0	0	0	0
Newton	8	531	85	8	1	0	2	0	0	0
Nodaway	6	433	136	129	24	2	0	0	0	0
Oregon	3	152	30	5	0	1	0	1	0	0
Osage	8	406	197	30	7	0	4	3	0	0
Ozark	7	305	90	27	1	0	0	2	0	0
Perry	4	349	139	4	2	0	0	2	0	0
Pettis	6	480	156	35	9	0	0	6	0	0
Phelps	7	330	196	15	3	3	2	2	0	0
Pike	19	714	272	66	11	4	2	6	0	0
Platte	17	353	64	32	6	1	0	2	0	0
Polk	9	164	81	4	2	2	0	4	0	0
Pulaski	1	54	24	2	1	0	0	0	0	0
Putnam	2	479	212	45	10	0	1	3	0	0
Ralls	25	517	234	25	12	1	0	2	0	0
Randolph	12	482	447	53	14	1	1	3	0	0
Ray	2	115	102	16	7	0	0	0	0	0
Reynolds	4	87	77	0	0	0	0	2	0	0
Ripley	5	95	41	3	3	0	0	0	0	0
St Charles	29	669	190	53	12	0	0	2	0	0
St Clair	10	182	125	11	3	0	0	6	0	0
St Francois	6	111	131	3	0	0	0	1	0	0
St Genevieve	27	470	308	23	7	1	1	10	0	0
St Louis	28	568	344	68	18	5	0	0	0	0
Saline	5	81	215	11	3	0	0	1	0	0
Schuyler	11	229	182	63	6	0	0	5	0	0
Scotland	7	228	134	33	5	2	0	1	0	0
Scott	0	6	50	0	0	0	0	0	0	0
Shannon	2	102	58	0	0	0	0	1	0	0
Shelby	8	428	187	34	7	0	0	2	0	0
Stoddard	6	858	104	56	9	1	0	6	0	0
Stone	1	53	21	3	0	0	0	1	0	0
Sullivan	15	402	203	23	4	0	0	2	0	0
Taney	16	209	85	1	1	0	3	1	0	0
Texas	3	112	17	1	0	0	1	2	0	0
Vernon	9	257	64	7	3	0	0	2	0	0
Warren	9	261	210	14	9	1	0	3	0	0
Washington	8	60	37	8	3	0	0	1	0	2
Wayne	6	133	7	3	1	0	0	0	0	0
Webster	1	124	90	2	5	0	0	0	0	0

Worth	22	149	78	34	26	0	0	10	0	0
Wright	41	204	141	8	7	4	2	11	0	0

TRAPPING MATTERS WORKSHOP

EVALUATION OF THE 2011 TRAPPING MATTERS WORKSHOP

Background

Public opinion on trapping is often clouded by misinformation. The goal of the Trapping Matters Workshop is to provide wildlife professionals with the skills they need to communicate the importance of trapping as a wildlife management tool.

Since 2004, we have offered several Trapping Matters Workshops. The 2011 workshop was held on September 6th at the Missouri Department of Conservation (MDC) Southeast Regional office in Cape Girardeau. The workshop was attended by 20 MDC employees. Attendees included wildlife biologists, private land conservationists, naturalists, media specialists and conservation agents.

The workshop, a joint effort by MDC and the Association of Fish and Wildlife Agencies (AFWA), was organized by Justan Blair (MDC Resource Science Division) and Bryant White (AFWA). Workshop presenters included:

- *Bryant White*, furbearer research coordinator with AFWA, covered the extensive scientific research in the development of Best Management Practices (BMPs), which recommend the most selective and humane traps.
- *Doren Miller*, president of the Missouri Trappers Association (MTA), talked about the role of the MTA. He also gave a skinning demonstration and discussed the preparation of fur for market.
- *Daryl Damron*, a Damage Biologist with the MDC, gave a hands-on presentation covering the various traps, such as foothold traps and cable restraints.

Evaluation Results and Discussion

At the end of the workshop, participants were asked to provide feedback through an evaluation form. Fourteen evaluation forms were returned. Respondents rated each speaker from 1 (very poor) to 5 (very good), and all speakers received an average rating of 4.5 or higher.

Participants were asked about the knowledge they gained as a result of the workshop and if they would use this knowledge. A summary of the responses are shown in Table 1.

When asked what information they found surprising, participants mentioned how regulated trapping was, as well as the process of grading furs and the difference in the prices of different grades.

Table 1. Summary of responses regarding knowledge gained during the Trapping Matters Workshop.

	Number of Responses		
As a result of the workshop, do you feel you:	Yes	No	Unsure
Know the benefits of regulated trapping as a management tool?	14	0	0
Know how trapping is used to manage wildlife in your state?	14	0	0
Understand how to address trapping issues with stakeholders and the public?	14	0	0
Will use this information in your job?	13	0	1

When reviewing responses to what other information should be added, participants mentioned that there should be more on communicating our message to the public and more on communicable diseases in furbearers.

Daryl Damron demonstrates how to construct a dirt hole set using foot hold trap.

Based on workshop evaluations, participants gained knowledge of furs and trapping, and walked away with a better understanding of how to communicate the benefits of trapping to the public. 12 of 14 participants did not know most of what we covered and now have a better comprehension of how to convey a positive message when dealing with a complaint from the public or media about our agency's trapping policy.

A Trapping Matters Workshop is not planned for 2012, due to this year's low turnout and general lack of interest. After this year, we will reevaluate the need for the workshop and perhaps plan on hosting another in 2013. We will continue to provide assistance to MDC staff, and augment their knowledge about trapping on a case-by-case basis.

REDUCING OTTER USE OF SMALL PONDS

REDUCING OTTER USE OF FARM PONDS AND SMALL IMPOUNDMENTS

Background

Objectives of Otter Use of Farm Ponds and Small Impoundments in Missouri:

- Describe the extent and nature of otter depredations on fish in ponds and small impoundments in Missouri.
- Describe the biological and physiographic features of ponds and small impoundments in Missouri that have been depredated by otters and determine which variables are highly associated with otter depredation. This can be done in a variety of methods.
- Assess methods for pond and lake owners to use to reduce otter depredations on fish.

Otters on dock at Green Area pond

A small pond located at the Green Conservation area was selected as the primary research site for this project. A six-foot tall perimeter fence was constructed around the pond with the intent of keeping otters inside for observation.

Otters have been kept and observed in the pen at various times over the past four years. Scat counts of the captive otters conducted from January to June 2007 showed that each otter excreted approximately 5.5 scats per day. It was also noted that the pond had to be restocked every 3-4 weeks with 150-300 catfish. This is an indicator of the extent of depredation that can occur in small ponds.

Also during this time, various trap designs were introduced to test their effectiveness at capturing otters. Most traps consisted of coated 1x1 inch mesh wire cages attached to a dock. Frames of the cages were built with sealed PVC and floated well. A submerged entry method using a funnel design (similar to a minnow trap) proved ineffective, as otters were simply too powerful and nimble to be held by the close-behind wiring on the end of the funnel. One-way, spring loaded, submerged entry doors became the focus of much of the design work, and three different types were tried: Plexiglas doors, heavy wire doors (cage material), and iron welded doors with vertical bars. Another tested trap design was basically a floating platform (5x5 ft.) with a Plexiglas one-way entry in the center going down into the cage. The most successful traps were the Plexiglas and iron welded one-way submerged door designs. However, none of the designs met expectations and it was recommended that more traps be tested.

The other aspect of research performed was the testing of another trap design. This trap was a floating, top-entry design. The trap was placed in the pond at the Green Area otter enclosure (un-baited) as well

as at Blind Pony Lake (baited). Trail cameras were used to monitor how otters interacted with the trap at both locations. However, based on the photographic evidence, it appears that no otters approached the trap. We are unsure why the otters did not inspect the trap. It is possible they had seen traps before and therefore avoided it, or the otters were not using the areas where we placed the trap. Further testing will continue with this trap design at different locations.

Metabolic Rates

Based on the information gathered in 2007, we expanded our research efforts at the Green Area otter enclosure. In February 2008, Resource Science began working with Matthew Dekar, a graduate student from the University of Arkansas. His doctoral project is studying the seasonal metabolic expenditures of river otter. Metabolic rates from free-living otters have not been calculated preventing accurate estimation of consumption in wild otters. Therefore, assisting with this project gave us the opportunity to learn more about the possible extent of otter depredation in small ponds.

For this study we trapped three otters, one from Eagle Bluffs Conservation Area and two from a private pond west of Columbia. Upon capture the otters were taken to a veterinarian, where they were injected with doubly-labeled water and background and initial blood samples were drawn. The otters were then released in the Green Area otter enclosure before being re-trapped three days later. Upon recapture, the otters were taken back to the veterinarian, where final blood samples were drawn. The blood samples were taken to Arkansas for analysis of CO_2 production and energy metabolism, which was translated into biomass consumption rates. Analysis showed that the largest male otter that was held in the enclosure consumed approximately 5.5 lb of biomass per day, which was approximately 27% of his body weight. To date, this is the only consumption rate that has been estimated. However, once the analysis is complete, a consumption model can be developed that will allow researchers and managers to estimate the amount of each prey type consumed throughout the year. In addition, consumption estimates will give insight into the ecological constraints regulating otter populations. Finally, data from the studies will highlight important interactions and impacts of otters on prey populations, including sport fishes.

Progress to Date

A floating trap design was constructed and tested at the pond enclosure. The trap has an entry mechanism consisting of a hinged one-way Plexiglas door inside of an 8”-6” PVC pipe reducer. Otters seem to be less inclined to enter a trap if they cannot see through the door. In the new design, the Plexiglas door will be held out of the water so it does not get covered in algae (a problem in earlier trap designs). With this design, we are attempting to use all of the knowledge we have gathered to this point, that otters will go into a top-entry trap and have difficulty getting out of a Plexiglas door, to construct a trap that the otters will go into that is sealed in a way that they cannot escape.

Floating, top-entry otter trap design

We continue to test the floating, top-entry trap design as well as the side entry trap design at the Green Area and at a private pond. It appears that the otters will enter the trap when it is baited with live fish, but have found a way to get out of the top entry design. The original design used plastic fish throats, which are funnels of split plastic, as the entry mechanism. We thought the funnel-shape would inhibit the otters from getting out, but apparently they were able to widen the base of the funnel enough to exit. After re-working the entry design, we feel that these two traps have potential to be used in live trapping otters.

Otters are occasionally brought in to the Green Area enclosure from other conservation areas in the surrounding counties and their interactions with these traps are monitored.

BADGER STATUS IN MISSOURI

AN EXPLORATORY ASSESSMENT OF BADGER DEMOGRAPHICS AND CONSERVATION STATUS IN MISSOURI

The badger is uncommon in Missouri and is considered a species of conservation concern. Its official rank is Unrankable (SU), however, as little data are available to form the basis for a ranking. Our current study is designed to collect badger observations and specimens from across the state. We will use this information to better understand the demographics and distribution of badgers in Missouri and to provide data from which to refine the status of badgers in Missouri.

The badger is a harvested species in Missouri, but harvest numbers have historically been low (generally fewer than 200 per year since the 1960s, and fewer than 100 per year since the 1990s). Arkansas ranks the species as S1 (Critically Imperiled), Ohio and Indiana as S2 (Imperiled), and Kansas as S3 (Vulnerable). Iowa ranks the badger as S4 (Apparently Secure), reflecting their apparent increased abundance in the grassland and open habitats that dominate the state. This habitat preference is also seen in Missouri, as the majority of harvested animals are from the northern portion of the state, and especially from northwestern Missouri. However, relatively few occurrence locations are documented in Missouri's Natural Heritage Database.

Badger habitat has declined substantially in areas converted from grassland to intensive agriculture. Also, colonial rodents such as prairie dogs and ground squirrels (as in Missouri, where both Franklin's and thirteen-lined ground squirrels are also species of conservation concern) have been reduced or eliminated. Assessing the range and demographics of badgers in Missouri is hindered by a lack of information because 1) harvest data are insufficient to properly assess trends and 2) little baseline data are available on the biology and demographics of the species. To fill these knowledge gaps, we are using verified sightings from the public and badger carcasses obtained from fur trappers or hit by cars. Information obtained from reported badger sightings and collected carcasses is used to define the minimum range of badgers in Missouri, to make initial and preliminary insights into the demographics of the Missouri population and to better refine the status of the species in MDC's heritage database.

Preliminary Results

From May 2010 through June 2011, we received 86 reports of badgers in Missouri from staff and the public, see Figure 1. We collected 10 carcasses from trappers and the public from May 2010 through June 2011. These badgers are awaiting necropsy. Reproductive and age data will be determined by flushing uterine tracts and tooth cementum analysis, respectively.

From July 2011 to June 2012, we have received an additional 26 badger reports from the public to bring our total observation reports to 273. We have received 4 additional badger carcasses that are waiting to be necropsied. Badger carcass collection has decreased considerably in the past two years. We are no longer paying trappers for badger carcasses and currently are only receiving carcasses from MDC personnel and citizens interested in the study.

Table 1. Physical data from badger carcasses collected in Missouri from November through May 2010.

	Average Lengths (n = sample size)	Average Weights (n = sample size)
Whole (unskinned) carcass	65.0 cm (n=5)	8.7 kg (n=9)
Skinned carcass	59.2 cm (n=43)	5.9 kg (n=47)

Data collected during this study were used to study the relationship between habitat and badger occurrence in Missouri. Badger observations were compared to land cover, elevation and soil type. Habitat characteristics associated with badger observations were then compared to habitat across the state. Our results showed that 66 percent of observations occurred in grassland or cropland (Figure 2), 63 percent of observations occurred in alluvium and glacial drift soils (Figure 3) and 71 percent of observations occurred between 200 and 300 meter elevation (Figure 4).

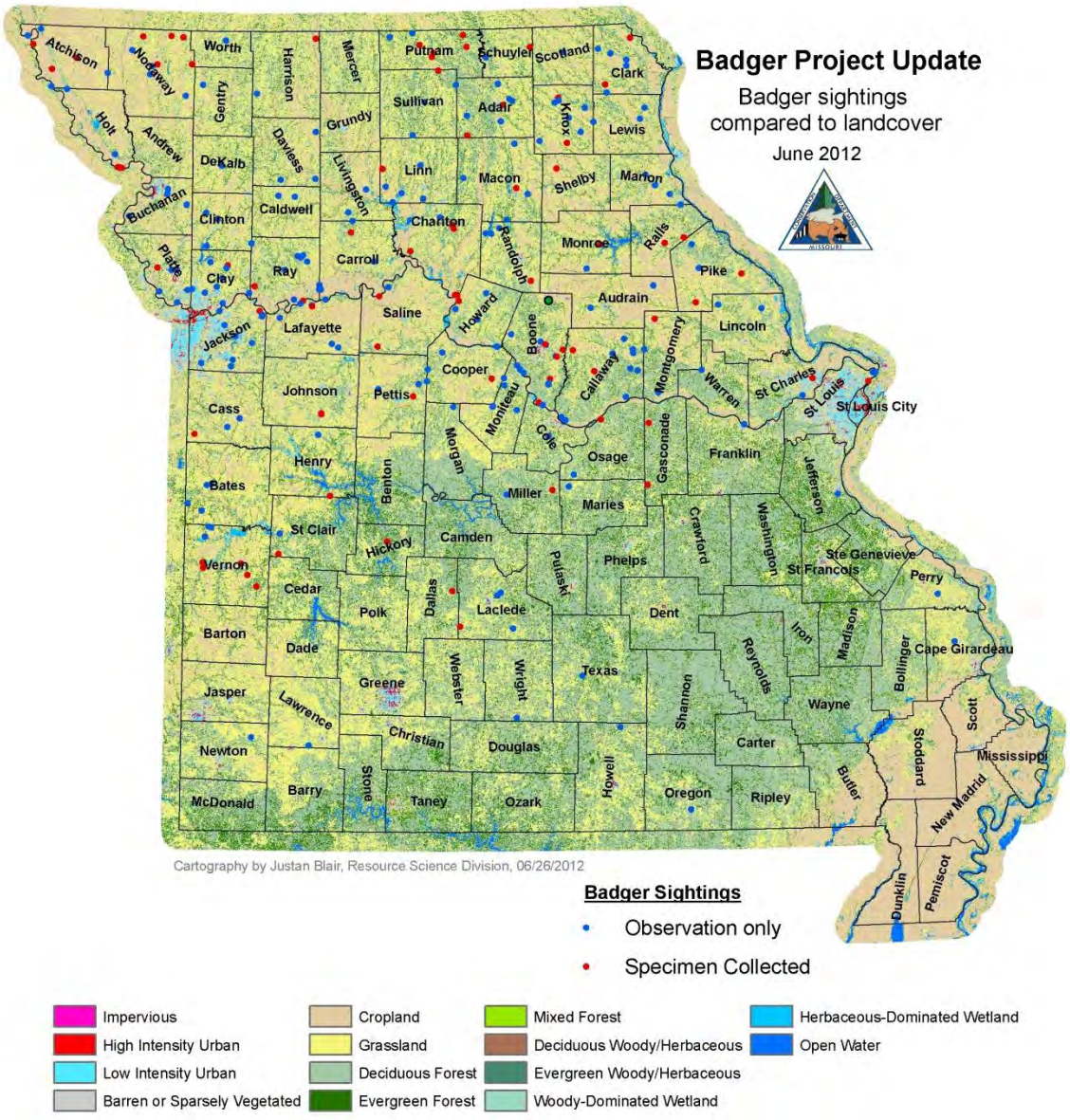


Figure 1. Badger locations based on reported sightings and carcass recoveries from trappers and road-killed animals.

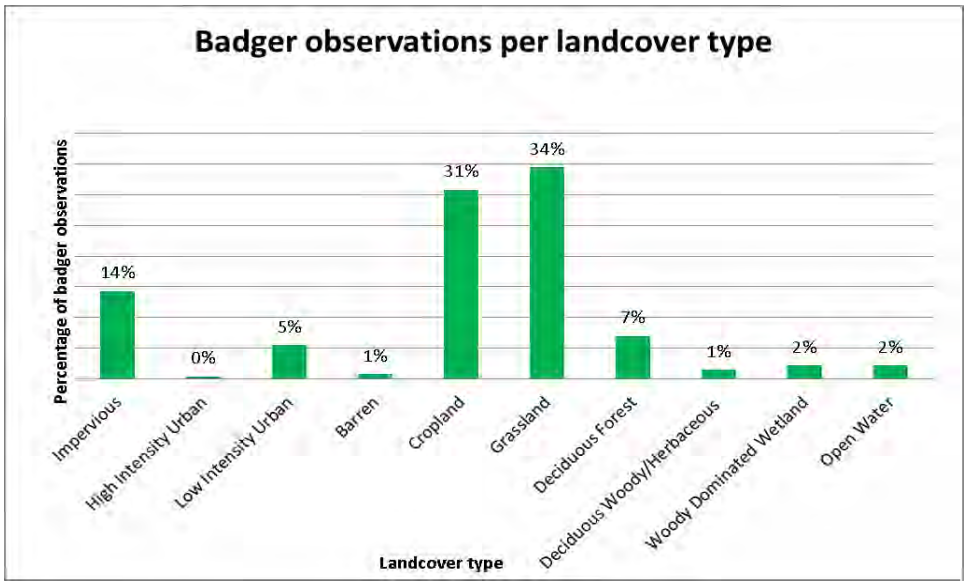


Figure 2. Percentage of badger observations per landcover type in Missouri.

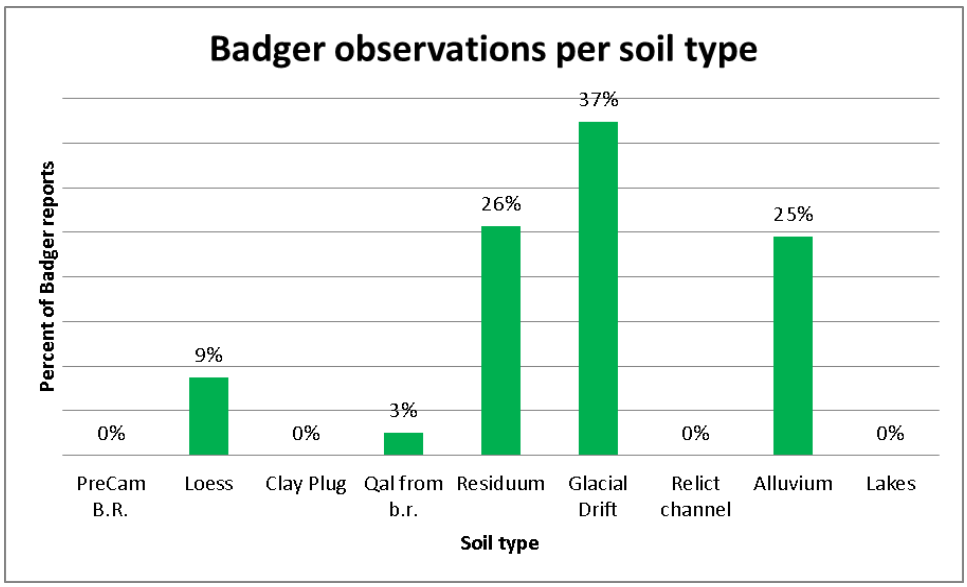


Figure 3. Percentage of badger observations per soil type in Missouri.

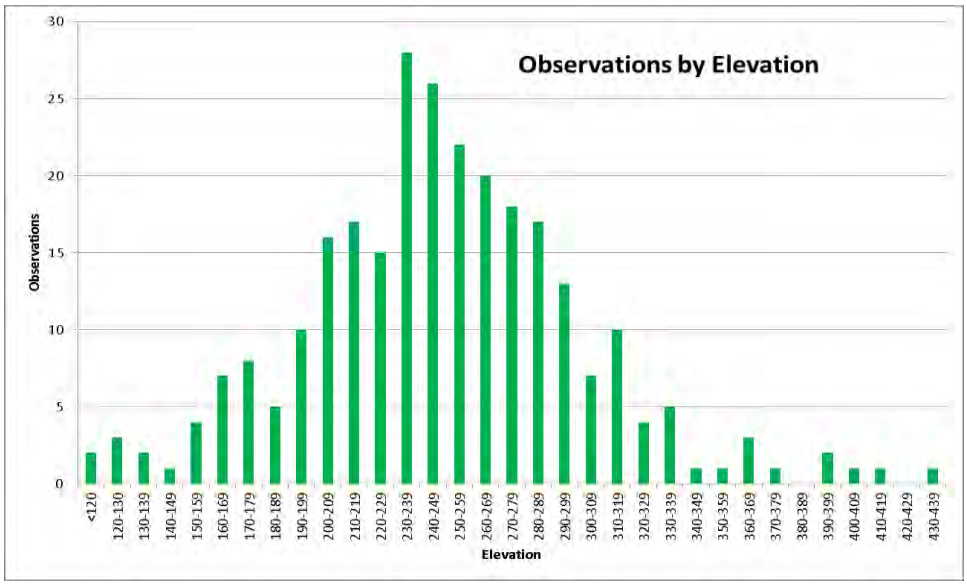


Figure 4. Badger observations compared to elevation in Missouri.

MONITORING AND DEMOGRAPHIC ASSESSMENT OF RIVER OTTERS AND BOBCATS IN MISSOURI

Currently, Missouri has no harvest level restrictions on river otters or bobcats. Past harvest data suggest these species are not in danger of being overharvested. Right now the harvest of these species is being challenged in Arizona and New Mexico. Our objective is to collect age, sex and harvest effort data for otters and bobcats to be used for Statistical Population Reconstruction.

Research Implications and Benefits

Statistical Population Reconstruction provides a broad scale assessment whereas most other techniques are applicable to only local areas. We will have a better understanding of the relationship between harvest rates and demographics of each species. Population reconstruction will also provide the MDC with solid harvest and population data which will be more defensible if ever challenged in the court system. This format will be our long-term monitoring plan. We will be collecting harvest effort and information from these two species for five years (2010-2014).

Survey packets are sent to Missouri trappers at the beginning of each trapping season. These packets contain a monthly journal asking how many traps were set for both river otters and bobcats, how many nights each trap was set, and how many of each species were trapped. This will reveal the amount of trapping pressure these species undergo each year. Trappers are also being asked to remove one of the lower canine teeth from each otter and bobcat they harvest. From the teeth collected we can determine the age of the harvested animals. This is important information for a population model to determine if the population is increasing, decreasing or stable. Separate envelopes are included in this survey packet for this purpose. The survey, along with the teeth from each harvested animal, are placed in a postage-paid envelope and sent back to Resource Science Division.

Survey packets were sent to trappers at the end of October 2010 for the 2010-2011 trapping season. In total, 760 lower canine teeth were collected from both river otters and bobcats. The samples consisted of 370 teeth being from river otters and 390 being from bobcats. In the 2011-2012 trapping season a total of 828 samples were received with 59 samples being cut too short for analysis. The 769 samples sent in for aging consisted of 284 bobcat samples and 485 river otter samples. See figures 1 and 2 for initial age analysis of samples.

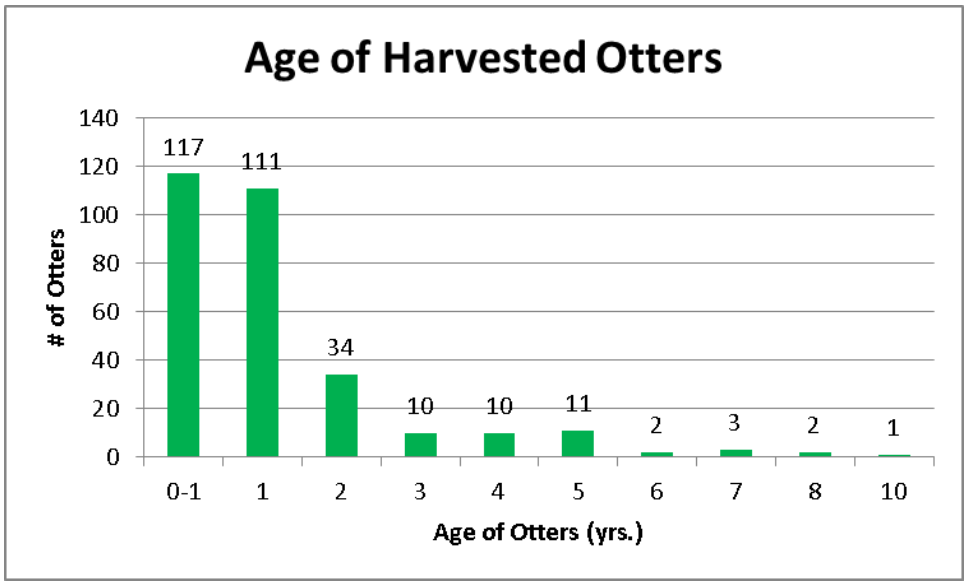


Figure 1. Age of otters sampled.

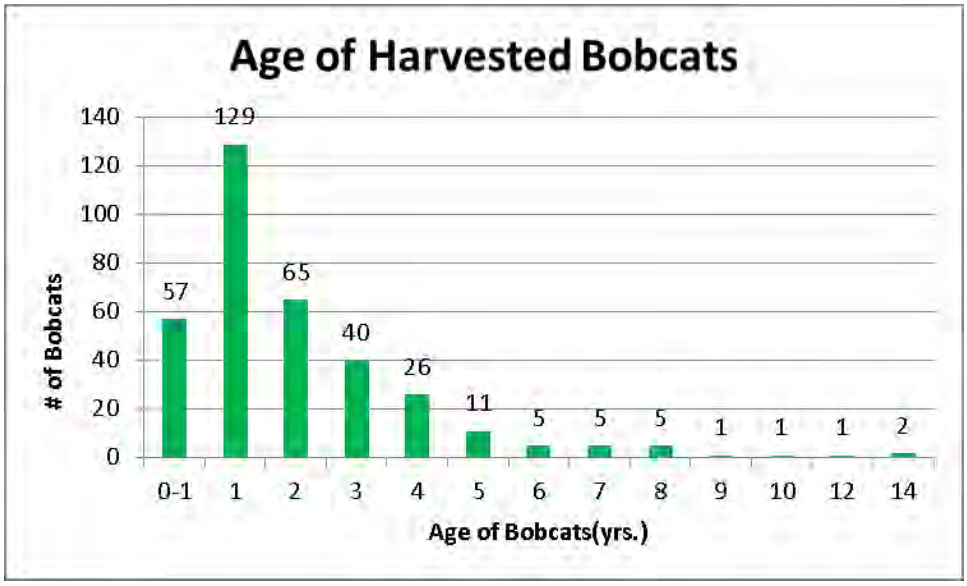


Figure 2. Age of bobcats sampled.

LARGE CARNIVORE INVENTORY

LARGE CARNIVORE INVENTORY AND MARKING STUDY: 2011 UPDATE

Background

Dangerous captive animals have recently come under public scrutiny. Because of the inherent danger and potential liability associated with the possession of large carnivores, an effective system was needed to verify ownership and better monitor the legitimate purchase, sale and trade of these animals. The Department of Agriculture is currently evaluating regulations for the possession of dangerous carnivores other than those regulated by MDC. The MDC has taken a proactive approach in response to the public demand for more accountability and to provide some consistency between us and the Department of Agriculture. The intent of these new provisions is to better enable our enforcement and record keeping obligations, safeguard permit holders from false claims of ownership, and satisfy public demand for higher accountability of these potentially dangerous animals. In addition, our Department will have the ability to distinguish captive animals from truly wild animals.

Based on these issues, MDC made significant regulation changes pertaining to large carnivores owned under the Class II Wildlife Breeder Permit. The proposal to permanently mark all captive bears, mountain lions, wolves and wolf hybrids was approved by the Regulations Committee and Conservation Commission in 2007. The regulation became effective march 1st, 2008 under code: 3 CSR 10-9.353 Privileges of Class I and Class II Wildlife Breeders and had a 1 July 2008 compliance date. Effective July 1, 2008, all mountain lions, black bears, wolves and wolf-hybrids held under the privileges of a Class II Wildlife Breeder Permit were required to be uniquely identified with a permanent Passive Integrated Transponder (PIT) microchip. These microchips are about the size of a grain of rice and contain an electromagnetic code that can be used to identify animals. They can be injected under the skin to permanently mark animals without altering external appearance. Microchips are normally placed just under the skin along the back of the animal, between the shoulder blades. This standardized protocol allows animals to be searched quickly and efficiently. The regulation also requires owners to allow the Department to obtain, from each animal, a small blood or tissue sample sufficient for DNA analysis.

Progress to Date

Surveys and interviews were completed for 33 of the then 50 captive carnivore owners in the state. Feedback from the interviews showed that a majority of owners are generally supportive of the new regulations, but have concerns about the welfare of their animals. An informational workshop was held in Jefferson City on February 9, 2008. The workshop provided a forum for MDC personnel, veterinarians and captive carnivore owners to discuss the procedures for marking captive animals. The contract with Wildlife Genetics International for DNA testing was finalized in May 2008, renewed in April 2009, 2010, and again in April 2011. DNA samples will be stored at Resource Science in Columbia until all samples have been collected and then will be sent to Wildlife Genetics International for analysis.

Department personnel have assisted in implanting microchips in and collecting DNA samples from 156 different animals at 45 facilities around the state. A total of 33 mountain lions, 27 black bears, 41 wolves and 55 wolf hybrids have been tagged. As of June 2012, all known owners of captive carnivores are in compliance with the regulation.

All permits to hold large carnivores expire June 30th of each year. Renewal letters and applications were sent to all current permit holders in April and May 2012. If the permits are not renewed by their expiration date, the permit holder is considered to be in violation of Missouri state code. Permit holders in violation may receive a citation from their local conservation agent if they wish to continue to hold large carnivores.

MOUNTAIN LION RESPONSE TEAM

MOUNTAIN LION RESPONSE TEAM

The Missouri Department of Conservation developed a Mountain Lion Response Team (MLRT) in 1996 to address the concerns and reports from the public of mountain lions and the occasional confirmed occurrence of a mountain lion in the state. The MLRT consists of 12 employees across the state. MLRT members have special qualifications or have received training to address mountain lion concerns and conduct investigations when evidence is present.

Mountain lion sightings are categorized and entered into a long-term database. We also keep track of confirmed cases of mountain lions in Missouri when there is hard, physical evidence to support a sighting such as a track, carcass, photo, video, etc. We have over 2,000 sightings in the database since 1994. We have been able to confirm the presence of 29 mountain lions in the state (Table 1, Figure 1).

During this past fiscal year we recorded over 264 reports of mountain lions in the state. This is a minimum number because many reports to local agency staff are not recorded. Most reports we receive are the result of our website reporting form and email account. We confirmed 12 mountain lion sightings this past year. During January of 2012 a young male mountain lion was trapped and then released in Reynolds County. The 122-pound cougar was captured in a live-trap on National Forest Service land near Centerville. We examined the cat, took a variety of measurements, collected tissue for DNA and then released it to the wild. The cat was in excellent physical condition and showed no signs of having been held in captivity.

Table 1. Confirmed Instances of Mountain Lions in Missouri.

Date	Location	Obs. #	Description
April/ 2012	Grundy Co	29	29 Photo of mountain lion taken by motion-activated game camera
Feb/ 2012	Reynolds Co	28	28 Photo of mountain lion taken by motion-activated game camera
Jan/ 2012	Reynolds Co	27	27 Citizen captured live mountain lion in live trap. Mountain lion was tranquilized, measured, weighed and released.
Sept/ 2011	Gasconade Co	26	26 Citizen reported seeing mountain lion. Hair sample collected. DNA confirmed.
Sept/ 2011	Carter Co	25	25 Citizen reported seeing mountain lion. Hair sample collected. DNA confirmed.

Sept/ 2011	Reynolds Co	24	Photo of mountain lion taken by motion-activated game camera
Sept/ 2011	Wayne Co	23	MDC employee reported mountain lion tracks in roadway. MLRT investigation confirmed.
Sept/ 2011	Shannon Co	22	Photo of mountain lion taken by motion-activated game camera
Sept/ 2011	Texas Co	21	Sub adult male shot by landowner. No obvious signs of confinement.
Sept/ 2011	Shannon Co	20	Photo of mountain lion taken by motion-activated game camera
Aug/ 2011	Oregon Co	19	Photo of mountain lion hindquarters taken by motion-activated game camera
Aug/ 2011	Shannon Co	18	Photo of probably subadult disperser taken by motion-activated game camera
April/ 2011	Macon Co	17	Citizen reported mountain lion tracks in creek bed. MLRT investigation confirmed.
March/ 2011	Oregon Co.	16	Citizen reported observing a cat jump a fence. DNA analysis of hairs collected at the scene confirmed species, ancestry analysis underway.
Feb/ 2011	Linn Co.	15	Photo of probably subadult disperser taken by motion-activated game camera
Jan/ 2011	Macon Co.	14	Subadult male shot by coyote hunters. No obvious signs of confinement. DNA analysis indicated probable South Dakotan ancestry.
Jan/ 2011	St Louis Co.	13	Photo of probable subadult disperser taken by motion-activated game camera.
Dec/ 2010	Ray Co.	12	Subadult male shot by raccoon hunter. No obvious signs of confinement. DNA analysis indicated probable South Dakotan ancestry.
Nov/ 2010	Platte Co.	11	Photo of probable subadult disperser taken by landowner. DNA analysis of hairs collected at the scene could not confirm ancestry.
Dec/ 2006	Livingston Co.	10	Photo of probable subadult disperser taken by motion-activated game camera.
Nov/ 2006	Shannon Co.	9	Deer carcass characteristic of mountain lion kill with tracks found nearby.

Aug/ 2003	Callaway Co.	8	Approximately 1½-year-old male road kill. No obvious signs of confinement. All four toes and pad of left forepaw missing but healed over (dewclaw present); cause of injury unknown, but did not appear to be trap-related. Stomach and intestines contained remains of squirrel, rabbit, and white-tailed deer. DNA analysis indicated North American heredity.
Oct/ 2002	Clay Co.	7	Two-to-three-year-old male road kill. No obvious signs of confinement. Intestines contained deer and raccoon hairs, and also man-made fibers. DNA analysis indicated North American heredity.
Dec/ 2001	Pulaski Co.	6	Photo of probable subadult disperser taken by motion-activated game camera.
Dec/ 2000	Lewis Co.	5	Video by deer hunter in a tree stand.
Jan/ 1999	Texas Co.	4	Animal treed by rabbit hunters' dogs. Tracks in snow, and two deer carcasses characteristic of mountain lion kills found nearby.
Jan/ 1997	Christian Co.	3	Video by property owner (obtained through Dr. Lynn Robbins at Missouri State University in Springfield). Animal's behavior suggested possible former captive.
Nov/ 1996	Reynolds Co.	2	Night-time video by Conservation Agent of cat on deer carcass.
Dec/ 1994	Carter Co.	1	Small adult female treed and shot (through the eye with a .22) by two raccoon hunters near Peck Ranch Conservation Area. Carcass was never recovered, but obtained photo of animal on truck tailgate. Federal authorities fined each hunter $ 2,000. In November 1998 a deer hunter found the skinned pelt of a small adult female with head and feet attached by a remote Texas County road. Pelt showed signs of freezer burn, and x-ray of skull revealed bullet fragments. Although likely the same animal, it cannot be confirmed absolutely.

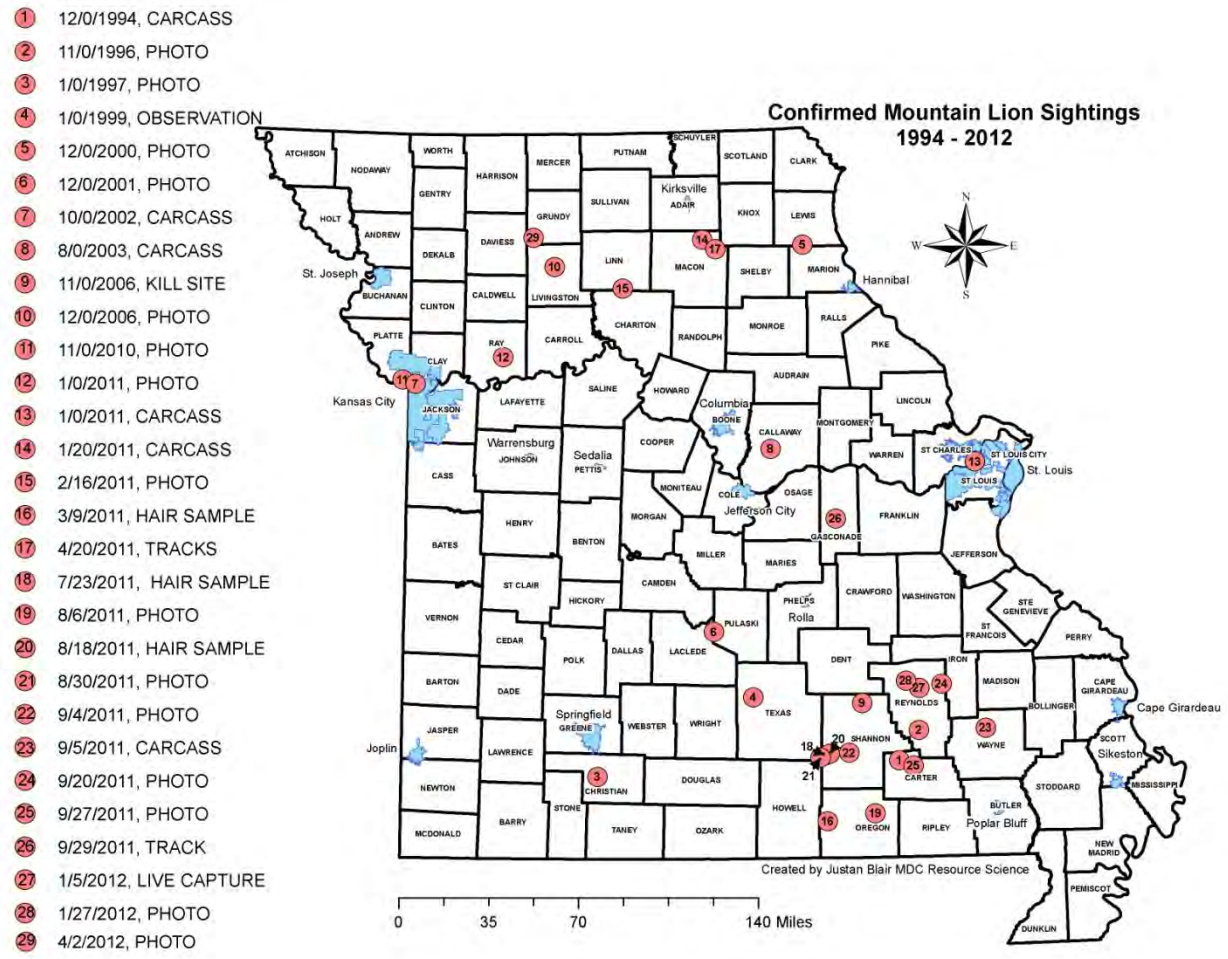


Figure 1. Confirmed locations and information for mountain lions in Missouri from 1994-2012.

BLACK BEAR DISTRIBUTION AND STATUS

Summary

We completed a new management plan for black bears in Missouri in 2008. The plan was drafted and approved by a multi-agency group of resource professionals from the Missouri Department of Conservation, U.S. Forest Service, National Park Service and Missouri Department of Natural Resources during summer of 2008 and was signed and approved by MDC administration during fall of 2008.

Black bear goal/vision statement:
To encourage black bear population expansion within their natural range in Missouri, and to manage black bears consistent with the available habitat and within the limits of human tolerance.

Black bear program objectives:

- Increase knowledge about current black bear population status in Missouri.
- Increase knowledge of black bear ecology in Missouri, how they move, disperse and travel on a landscape level and identify source and sink populations.
- Develop black bear conservation and management strategies based on information gathered through research, monitoring and surveys.
- Educate Missouri's public, the media and other resource professionals in Missouri and the Midwest about black bears and Missouri's black bear management program.

The entire black bear management plan can be viewed on SharePoint at:
http://mdcsharepoint/sites/resourcescience/Documents/Terrestrial%20Fauna/Furbearers/Black%20Bear%20Management%20Plan%20November%2025%202008.pdf.

Black bear research
American black bears (*Ursus americanus*) are an important wildlife resource in Missouri, yet little information is known about their population status. Black bears were believed to be extirpated from Missouri by the early 1900s due to overharvest and deforestation; however, they have been naturally recolonizing and increasing in abundance in southern areas of the state since the 1960s. Increased abundance has resulted in more interest in black bears as well as nuisance complaints and safety concerns from the public. The Missouri Department of Conservation (MDC) is encouraging range expansion of black bears while managing the species consistent with available habitat and within limits of human tolerance. Our intent is to conduct research that will increase knowledge of black bear ecology critical for developing conservation and management strategies. The objectives of this project are to:

1. Develop synthesis of history, status and management of black bears in Missouri;
2. Quantify occurrence and magnitude of heterogeneity in capture probabilities, and
3. Estimate abundance and density of black bears in Missouri.

In a recently recovering population of black bears, such as in Missouri, establishing an accurate and robust baseline population estimate is critical for developing a reliable long-term conservation plan. The estimated population size derived from this overall study will influence decisions to implement a bear

hunting season in the state. Understanding the sources of heterogeneity in Capture Mart Recapture studies is essential for producing sound population estimates to manage Missouri's black bear population.

Study Area

The study area was derived from the 70 percent fixed kernel isopleth applied to black bear sightings (1989-2010) and comprises 29,775 km^2 in southern Missouri (Figure 1). The area was divided into 2 regions to be surveyed in different years: the south-central region in 2011 (13,508 km^2) and the southeastern/east-central region in 2012 (16,267 km^2). Land ownership is private and public, including Mark Twain National Forest and Ozark National Scenic Riverways. Predominant land covers include cropland (30.9%), pastureland (24.3%) and forest land (27.8%); (National Resources Inventory 2000). Forest cover in southern Missouri is dominated by oak-hickory (*Quercus alba, Quercus velutina, Quercus coccinea, Quercus rubra, Carya spp.*) and oak-pine (*Pinus echinata*) upland type forests (Missouri Department of Conservation 2011). Southern regions are rugged and mountainous with elevations ranging from 70-540 m (United States Geological Survey 2009). The Ozark Mountains are characterized by exposed formations of sandstone, chert, dolomite, limestone and igneous rocks (Batek et al. 2001). Southern Missouri (Climate Division 4 and 5) temperatures average 23.8°C (June-July 1989-2010) and precipitation (June-July 1989-2010) averages 218 mm (National Climatic Data Center 2011).

Methods

Physical capture and marking of black bears

Black bears are captured during September-October and May-August using Aldrich foot snares and culvert traps. Captured bears are immobilized with 7 mg/kg tiletamine-zolazepam administered using a CO_2-powered rifle or syringe pole. Temperature, heart rate and respiration are monitored every 10 minutes during immobilization for at least 20 minutes post-induction. Morphometric measurements and body weight is recorded for each individual and an upper premolar tooth extracted for cementum aging analysis. Minor wounds caused by capture are treated with Betadine. Male and female bears are ear tagged and fitted with GPS collars (Northstar NSG-LD2, RASSL Globalstar, King George, Virginia, USA) programmed to collect locations every 10 minutes from 30 May to 28 July and one location per day thereafter. Ten-minute locations were chosen to maximize detail of bear movements during hair snare sampling sessions and are automatically downloaded directly to an online database (Northstar Science and Technology, LLC) and illustrated using GIS.

Hair trapping experimental design

We are collecting hair samples from black bears using hair snares constructed using a double strand of 4-barbed, 15.5-gauge wire to create an enclosure around 3 or more trees, about 50 cm above ground. Anise is sprayed on perimeter trees forming the enclosure, about 2 m above ground. Decaying logs are placed in the center of the enclosure and saturated with 0.5 L of fish oil as an attractant. Hair snare stations are re-lured every 10 days at the beginning of five consecutive sampling sessions, with the first session beginning late May or early June 2011 and 2012. DNA hair samples are collected at the end of each sampling session. All hair found on a barb or single tree is considered one sample. Each sample is placed in separate paper envelopes, labeled and air dried before processing. Each barb is flamed to ensure DNA has been removed.

We designed field methods to maximize detection of sex and temporal biases in black bear DNA collection with hair snares. About 350 hair snares were deployed in the south-central region in 2011 (Figure 2) and about 350 hair snares in the south-eastern/east-central region in 2012. Hair snares were distributed based on habitat characteristics and distribution of bear sightings (1989-2010). We overlaid a 9 x 9 km grid over the study area to generate a distribution of bear sightings per grid cell, excluding cells with zero bear sightings. Hair snares were allocated proportionately to the number of sightings per cell. For the 2011 study area, cells containing 1-3 bear sightings received 1 snare per sighting. Each cell containing 4-5 bear sightings received 4 snares, cells with 6-7 sightings received 5 snares, cells with $\geq$8 sightings received 6 snares. Sightings were screened for probable resightings and the number of snares per cell adjusted accordingly. Cells with suitable habitat (e.g., forest) containing zero sightings adjacent to cells with similar habitat containing bear sightings were allocated snares comparable to adjacent cells. Allocation of snares for the 2012 survey area varied depending on the distribution of sightings per grid cell. We used GIS to select approximate locations for hair snares using forest cover data (30m resolution,

Missouri Spatial Data Information Service 2005) as initial criteria to maximize bear detection; excluding open water, agricultural and developed areas.

Final hair snare locations were placed within 300 m of initial random locations and out of sight from human trails or dwellings. Additionally, previous bear sightings, recent bear activity, and expert opinion of MDC staff were used to select hair snare locations to maximize black bear capture. We attempted to maintain a minimum distance of 3 km between hair snare sites to reduce sampling bias, and conducted oversampling of snare locations in the event existing land use or ownership precludes snare placement. We established about 380 hair snare stations per year (1 snare/38.6 km^2 in 2011, 1 snare/46.5 km^2 in 2012).

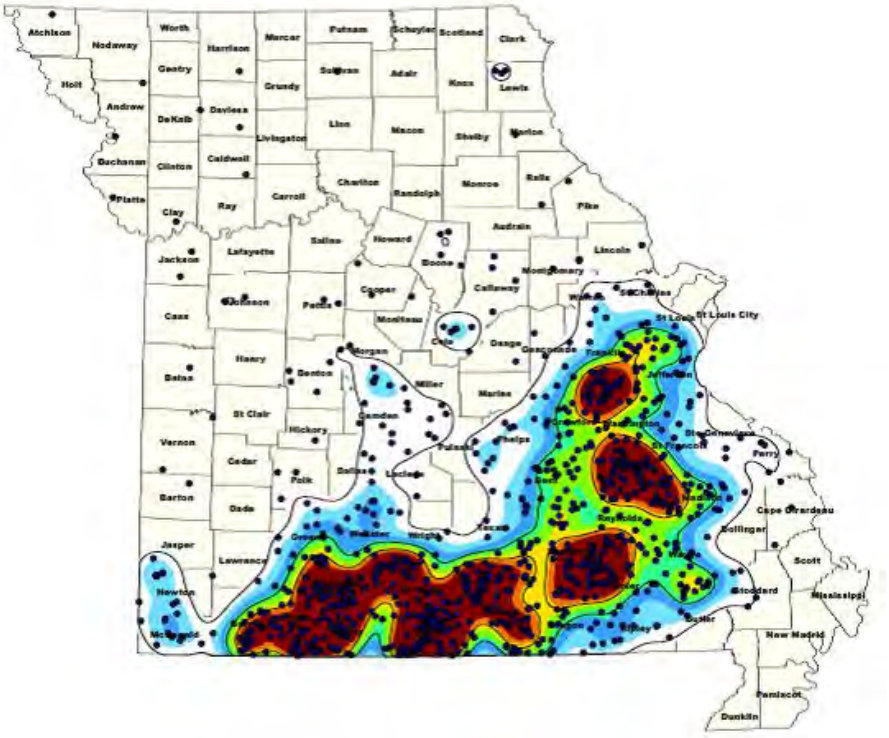


Figure 1. Kernel density estimation of black bear sightings (1989 – 2010) with 70% isopleth highlighted in light blue.

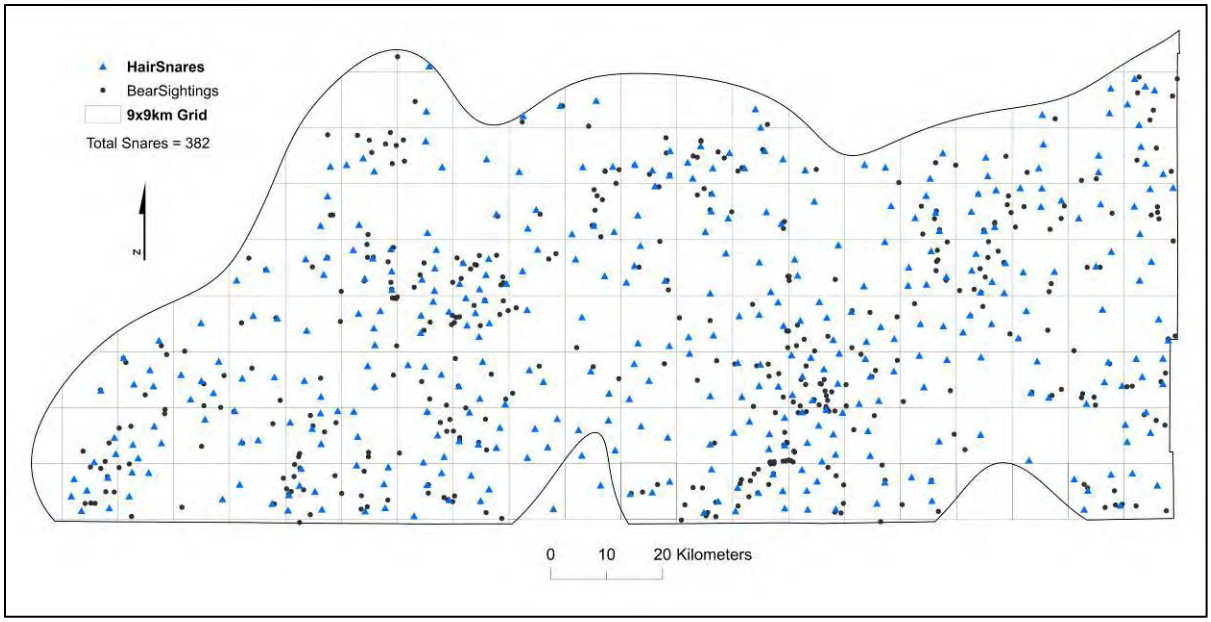


Figure 2. Distribution of hair snares and black bear sightings (1989-2010) for 2011 survey area, southcentral Missouri.

Progress to date

In September of 2010, the Missouri Department of Conservation, in cooperation with Mississippi State University and with funding from the Federal Aid in Wildlife Restoration Act, began the first ever black bear research project in Missouri. Personnel from multiple divisions assisted in the capturing and collaring of black bears across the state.

From July 2010 to May 2012, we captured 45 different bears 65 times. Of those, 28 were males and 17 were females. All captured bears were outfitted with ear tags in both ears for identification. Males were outfitted with blue ear tags and females with yellow ear tags. Bears large enough to carry radio-collars were fitted with collars that have both GPS and VHF functions.

The weights of bears varied greatly. Cubs of the year weighed up to 70 pounds (a good indication of strong growth). Two adult males were trapped that weighed over 400 pounds. The largest bear trapped weighed over 485 pounds. The mean weight of adult male bears was 280 pounds. The mean weight of adult female bears was 185 pounds. Cubs of the year were not included in mean weights.

We collected 87 black bear hair samples from 23 snares (6%) and 46 bear images from 19 cameras at snares. Of these snares with remote cameras, 13 were visited by marked bears (8 snares with GPS-collared bears, 5 snares with ear-tagged bears), and 10 snares were visited by unmarked bears. Number of black bear hair samples collected declined across sessions ($\overline{X}$ = 14.5, range = 7-24;). Total active snares per session remained about constant ($\overline{X}$ = 6.5, SD = 0.55) throughout sampling sessions. The addition of the 3 new lures did appear to increase detection at hair snares, with 3 new active snares during session 5 and 6, although total active snares during these sessions did not differ from previous sessions. Preliminary results of active hair snares indicate low detection probability at hair snares and that bears are likely distributed in clusters with individuals sparsely distributed between clusters.

Our bear population estimate for the SW portion of study area was a point estimate of 108 bears with a 95% confidence interval of 65 – 156. I believe this is a reasonable estimate based on samples collected; our trapping and observational data also support the fact that we likely have 4 small populations with reproducing females, (Figure 3.). Between these populations it appears that we have subadult male bears without established home ranges. These subadults travel widely, are more visible and may lead to

higher sighting rates by the public -thus adding to a perception that we have more bears than our data indicate.

Last year's hair snare effort was broad and coarse. We did not know where on the landscape our bear populations were and so we cast a wide net. This wide net revealed the same populations we found through prebaiting and trapping. We plan to resample this summer but will focus on these known bear populations. This approach will be more fine-tuned and will enable us to better estimate bear numbers in these areas because we will have a dense hair snare grid and thus more recaptures. The caveat to this approach is that there could be bear populations of which we are not aware. For example I suspect we may have a bear population in northwest Ripley and northeast Shannon counties but we have not captured females in either location. During the summer we will continue to look for evidence of breeding females in new locations.

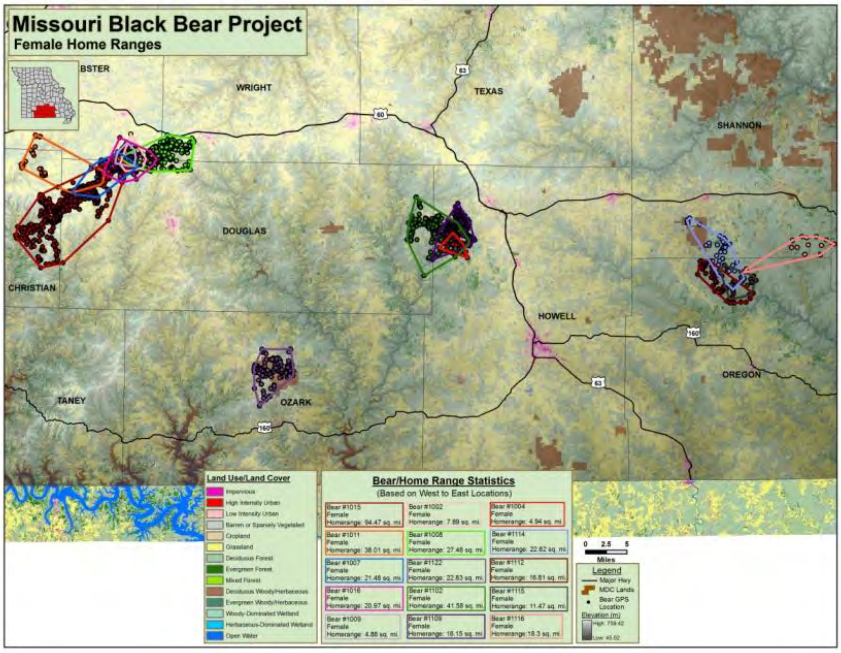


Figure 3. Female black bear home ranges.

2012 Field Season

We again hired field technicians to help deploy 81 hair snares in each five 9 mile x 9 mile grids (405 total snares) across the estimated core black bear range in Missouri during May 2010. Individual hair snares were constructed as in 2011 except an additional strand of barbed wire was placed 20 cm above ground. Snares were checked on 6 occasions at 10-day intervals during June-July 2012. As in 2011, genetic samples will be processed by Lori Eggert at the University of Missouri-Columbia. After results are received in late 2012, we will conduct spatial capture-recapture models to estimate black bear abundance. In addition, we will compare efficacies of the two approaches used for abundance estimation of an uncommon, but large carnivore species.

Acknowledgements

We thank the many MDC personnel that assisted with private lands access, hair snare construction and various logistical matters. Funding sources included MDC, Federal Aid in Wildlife Restoration, Safari Club International Foundation and Mississippi State University.

Our current research proposal designed to quantify black bear numbers and sex ratios in parts of southern Missouri can be viewed on SharePoint at: http://mdcsharepoint/sites/resourcescience/Documents/Division%20Administration/Programs%20and%20Projects/FY11%20Projects/One%20Page%20Proposals/Bearpopest_FY11%20One%20Pager.docx.


Photo courtesy of Danny Brown

MIDWEST FURBEARER WORKSHOP

This year's furbearer workshop was hosted by the Missouri Department of Conservation (MDC). The workshop was held at Trout Lodge in southeast Missouri from 1-4 May 2012.

ATTENDANCE

Thirty-six (36) participants attended this year's workshop, including state furbearer biologists from 10 Midwest member states (North Dakota, Nebraska, Kansas, Oklahoma, Missouri, Illinois, Michigan, Ohio, Kentucky and Wisconsin) and attendees from other organizations/agencies including: U. S. Fish & Wildlife Service, Association of Fish and Wildlife Agencies, USDA APHIS Wildlife Services and National Wildlife Research Center, University of Mississippi, University of Missouri, Fur Takers of America, Missouri Trappers Association, Illinois Natural History Survey, and wildlife and private lands biologists from Missouri Department of Conservation.

EXECUTIVE SUMMARY

Attendees of the 2012 Midwest Furbearer Workshop were welcomed by Dan Zekor, Research Center Unit Chief. Local historian Bob Priddy gave an enlightening and humorous plenary talk covering trapping and its role in early Midwestern states. Ken McCarty (Missouri Department of Natural Resources) spoke on the role of fire and fire ecology in shaping habitat communities in oak forests. Numerous speakers presented information on issues relative to furbearer research and management. Professional presentations were given on the following topics:

- The National Wildlife Research Center's furbearer research program
- Statistical Population Reconstruction as a Tool to Model Furbearer Populations
- Using Hair Snares to Estimate Bobcat Populations
- Organohalogenated Compounds in Illinois River Otters
- Effects of Climate and Trapper Success on River Otter Survival in Missouri
- Best Management Practices for Trapping in the United States
- Insights from Long-Term Studies of Raccoon Disease Ecology
- Badger Sighting and Land Use in Missouri
- Telazol as a Field Immobilizing Agent for Beaver (*Castor canadensis*)
- Tickborne Disease Overview
- Tularemia and Plague Surveillance in the Midwest
- Issues with Urban Black Bears and Coyotes

The somewhat isolated setting allowed for relaxed, group participation in numerous discussions throughout the course of the meeting, during meals at the Trout Lodge Center and evening bonfires. Otter, raccoon, transient mountain lion movements and disease issues in fox populations were a few of the highlights of these discussions. The multi-state decline in red and grey fox populations, mountain lion movements and similar issues with otter and bobcat management pointed to the need for collaboration among states in collecting and analyzing harvest and observational data. As a result of these discussions, we are moving towards uniform data collection and analysis using statistical population reconstruction for a least 2 species. This approach will allow states to use harvest data collected from

CITIES registration to build robust population models for otter and bobcat. Comparing harvest, trapper effort and sex and age composition between states will enable us to measure the impact of different regulations and trapper numbers on population structure and growth.

We tried something a little different this year – an idea exchange among biologists. The concept was for biologists to bring an idea or product that they found particularly useful in their jobs or vocation. During this forum we saw a couple of new ideas and designs for bear traps, were presented information on new trail cameras, discussed techniques for cable restraints, otter trap designs, and had presentations on 2 dog-proof modifications of 220 conibears. The exchange of ideas fit well into the concept of collaboration and working together as all furbearer biologists face similar issues in their states.

Forums such as the Midwest Furbearer Workshop provide valuable opportunities for state furbearer biologists to become acquainted with emerging issues and exchange information and ideas related to furbearer research and management. The need for state fish and wildlife agencies to establish and maintain furbearer biologist positions and support travel of furbearer biologists to the annual Midwest Furbearer Resources Workshop is imperative for exchanging information to promote quality furbearer management and research in each state. It is more important than ever that state agencies are in the forefront of issues related to furbearer management and trapping in order to protect the heritage and recreational opportunities of hunting and trapping for future sportsmen and sportswomen. Following are abstracts of presentations given at the workshop:

Managing to reduce human-carnivore conflict: current research and future directions

Julie K. Young, *USDA-WS-National Wildlife Research Center-Predator Research Facility, USU-BNR 163, Logan, UT 84322-5295*

Factors that influence the behaviors of humans and carnivores often determine the type and severity of interactions between both. As the US human population increases, more people recreate or work on public lands and develop communities in former wildland areas, human-carnivore conflicts are likely to increase. Identifying the causes of conflict and ways to reduce occurrence are needed to enable wildlife and humans to coexist. Research conducted at the NWRC-Predator Research Facility is devoted to resolving problems caused by the interaction of carnivores and society. Research focuses on understanding and managing prey and population dynamics, intraguild interactions, urban carnivores, and reducing depredation. Here, I describe several examples of on-going and developing studies related to each of these topics and discuss issues that are likely to become increasingly important. By understanding how and why conflict occurs, we can better manage to reduce it.

Effects of climate and trapper success on river otter survival in Missouri

Jerrold L. Belant, Carnivore Ecology Laboratory, Mississippi State University
Jeff Beringer, Resource Science Division, Missouri Department of Conservation
Nathan S. Libal, Carnivore Ecology Laboratory, Mississippi State University
Guiming Wang, Department of Wildlife, Fisheries and Aquaculture, Mississippi State University

Abstract: Understanding factors that influence survival of harvested species is critical for effective wildlife management. Once historically abundant in Missouri, river otters (*Lontra canadensis*) were considered extirpated by the 1930s. Otters were reintroduced from 1982 to1992 and the population increased such that an annual trapping season beginning in 1996–1997 was authorized. We conducted a radio telemetry study during 2000–2008 to estimate river otter survival during trapping and non-trapping periods in relation to coarse-scale climate metrics and proportion of trappers successfully capturing otters (i.e., trapper success). We used dead recovery models in program MARK and information-theoretic techniques to estimate which factors influenced survival of 214 otters from two study areas. The most supported model affecting survival included otter sex and group effect of trapper success ($\omega = 0.37$) with the competing model including group effect of trapper success only ($\omega = 0.36$). Otter survival was greater for females than for males, was lower during trapping seasons, and overall survival increased as trapper success decreased. Proportion of trappers that were successful in harvesting $\geq$1 otter increased with

otter pelt price until pelt prices reached $60–70 US ($R^2_7$ = 0.95). Otter survival was affected by the proportion of successful trappers whose success was influenced by pelt price. Climate may have a limited effect on otter survival but is overshadowed by trapper success.

The 20th century accumulation of Organohalogenated compounds in Illinois river otters

Authors: Samantha K Carpenter[1], Nohra E. Mateus-Pinilla[1], Kuldeep Singh[2], Andreas Lehner[3], Damian Satterthwaite-Phillips[1], Robert D. Bluett[4], Nelda A.Rivera[1], and Jan Novakofski[5]

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Abstract: Organohalogenated compounds (OHCs), including polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and organochlorine pesticides (OCPs), are of global concern because of their environmental persistence, bioaccumulative potential, and deleterious effects on wildlife and humans. The North American river otter (*Lontra canadensis*) is a top-trophic predator in the aquatic ecosystem of Illinois and therefore is vulnerable to the bioaccumulation of OHCs. We analyzed concentrations of OHCs in livers of 23 river otters salvaged by the Illinois Department of Natural Resources from 2009 to 2011. Our objectives were to: 1) determine the concentrations of 20 OHCs in livers of river otters collected in Illinois during 2009-2011, 2) determine sex and age-dependent distribution of OHCs, and 3) compare current results to reported concentrations in 1984-1989 of four OHCs in Illinois river otters. We anticipated lower OHC concentrations compared to those reported 20-25 years ago in Illinois. The highest concentrations of OHCs were PCBs, dieldrin, and 4,4'-DDE. Mean PCB concentrations were significantly higher in males than females (p = 0.04). Mean concentrations of dieldrin (653 µg kg¬-1 wet wt) were significantly greater than those detected from 1984 to 1989 (340 µg kg¬-1 wet wt; $p < 0.05$) and mean concentrations of HE (30 µg kg¬-1 wet wt) were lower (50 µg kg¬-1 wet wt; $p < 0.05$). Our results highlight the need for a more thorough understanding of contaminant accumulations by river otters across different watersheds of Illinois. Insights from Long-Term Studies of Raccoon Disease Ecology

Insights from Long-Term Studies of Raccoon Disease Ecology

Matthew Gompper, Department of Fisheries & Wildlife Sciences, University of Missouri, Columbia MO 65211
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For over a decade we have been examining how raccoons and their micro-, macro-, and ecto-parasite communities respond to experimental alterations in food access and alterations in social contact. Work commenced in New York in the late 1990s and then expanded considerably in scope, ultimately involving data collection from over 700 individuals from 12 populations inhabiting rural forested habitats in central Missouri. Here I summarize some of the primary results gained from the work to date. These include insights on how raccoon home range use responds spatially to locally abundant resources, the rates of exposure to important parasites (including several of management interest such as *Baylisascaris procyonis*, canine distemper, and raccoon parvovirus), how contact rates and access to supplemental food influences the parasite communities of raccoon and influence viral exposure over short and long terms, and how environmental, demographic, and genetic factors intrinsic and extrinsic to the hosts influence the likelihood and extent of parasitism.

Land Use of the American Badger (*Taxidea taxus*) in Missouri

Blair, Justan, Spencer Lynch, and Jeff Beringer. Missouri Department of Conservation, 3500 East Gans Road, Columbia, Missouri 65201, (573) 815-7900,

The American Badger is a species of concern in Missouri. Trapping results have consistently been low, with the fifty year average being less than one hundred individuals a year, and observations are few, providing us with little data, resulting in an official rank of Unrankable (SU). Reports of observations and specimens collected during the *Exploratory Assessment of Badger Demographics and Conservation Status in Missouri* project were used in conjunction with land cover, soil type and elevation GIS maps to determine what habitat is most preferred by the American Badger in Missouri. Preferred habitat of badgers in Missouri was found to be in cropland and prairie land cover types consisting of alluvium and glacial till soils. Elevation played a key role in habitat selection as well, with the majority of badgers occurring within 200-300 meters in elevation. With this knowledge, habitat management efforts can be focused on conservation areas that are located within ideal American Badger habitat, increasing the efficient use of department resources and man hours.

TELAZOL® AS A FIELD IMMOBILING AGENT FOR BEAVER (Castor canadensis)

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DALE NOLTE, USDA/APHIS/Wildlife Services-National Wildlife Disease Program, 4101 LaPorte Ave, Fort Collins, CO 80521
JEANNE JONES, Mississippi State University-Forest and Wildlife Research Center, Thompson Hall Room 201A, Mississippi State, MS 39762

Abstract: Many chemicals and combinations of chemicals have been described to immobilize and anesthetize aquatic rodents; however, poor muscle relaxation, induced excitement, and seizures are common. Approaches that produce safe and effective immobilization generally include intramuscular (IM) injection, rapid onset of the anesthetic with a high therapeutic index, and quick recovery. Telazol® (1:1 tiletamine hydrochloride (HCL) and zolazepam HCL) has been used successfully to immobilize a variety of mammalian species except beaver. Smooth induction and retention of reflexes supported the field evaluation of Telazol® as an immobilant for beaver. Beaver (n = 25) were immobilized with decreasing dosages of Telazol® in an effort to shorten immobilization time without lengthening induction time. Data are reported for application for field use, including a comparison between dosage and induction time (mean = 4.64 minutes) and between dosage and immobilization time (mean = 115.84 minutes). Induction and immobilization times between genders are also presented.

Use of Modified Snares to Estimate Bobcat Abundance

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Abstract: Although genetic and analytical methods for estimating wildlife abundance have improved rapidly over the last decade, effective methods for collecting hair samples from terrestrial carnivores in a mark-recapture framework have lagged. Hair samples are generally collected using methods that permit sampling of multiple individuals during a single sampling period that can cause genotyping errors due to cross-contamination. We evaluated a modified body snare as a single-sample method to obtain bobcat hair samples suitable for individual identification using DNA analyses to estimate population size. We used a systematic grid (2.5 x 2.5 km) overlaid on a 278.5 km^2 study area in Michigan's Upper Peninsula to distribute sampling effort. In each of 44 grid cells, we placed 2–6 snares at established sampling stations and collected hair samples weekly for 8 weeks during January–March 2010. We collected 230 hair samples overall, with 91% of sampling stations obtaining at least 1 hair sample. Fifty-seven percent of samples had sufficient DNA for species identification which included bobcat (*Lynx rufus*, *n* =17); raccoon (*Procyon lotor*, *n* = 62); coyote, dog, or wolf (*Canis* spp., *n* = 29); fox (*Vulpes vulpes* or *Urocyon cinereoargenteus*, *n* = 4); and fisher (*Martes pennanti*, *n* = 1). We identified 8 individual bobcats and using Huggins closed capture population models with a mean maximum distance moved buffer, estimated 10 individuals within the trapping area (95% confidence interval = 8–28) with a density of 3.0 bobcats/100 km^2. Our method provides an effective, single-sample technique for detecting bobcats and estimating abundance.

Tularemia and Plague Surveillance in the Midwest

Sarah Bevins, Wildlife Services National Wildlife Disease Program

Abstract: Tularemia and plague are zoonotic diseases that can be transmitted from wildlife to people, either through direct contact or through an insect vector. Both diseases are now relatively rare in the U.S., but die-offs in wildlife, as well as human cases, still occur every year. The USDA/APHIS/WS National Wildlife Disease Program, in collaboration with the Centers for Disease Control and Prevention, coordinates a large-scale plague and tularemia monitoring program in wildlife sampled from across the U.S. Samples are collected in collaboration with animal damage management activities, and have resulted in an unprecedented dataset of nearly 50,000 samples collected over a 7 year period. Data have shown substantial plague exposure, particularly in carnivores, and has also revealed clusters of disease that vary over time and region. Valuable plague and tularemia data are being gathered from wildlife and they offer a unique opportunity to better understand the ecology of the two pathogens.

Emerging Issues with Urban Black Bears and Coyotes, what is the roll for "traditional" and "non-traditional" forms of management for reducing conflict?

Stewart Breck, Research Wildlife Biologist, USDA-WS-National Wildlife Research Center,4101 Laporte Ave, Fort Collins, CO 80521

Human-wildlife conflict with carnivores in urban environments is an emerging issue in areas throughout North America. In this presentation I have three objectives. First, I will review ongoing research I am conducting on black bears and coyotes in Colorado. This will include highlighting data from 6 years of urban bear work that focused on movement and behavior of bears relative to urban environments and an introduction to the coyote issue associated with the Denver Metro Area and how I propose to address them. Second I will review some of the "non-traditional" strategies employed to reduce conflict, including education and non-lethal methods like hazing. Finally, I will speculate on the role of more "traditional" management strategies (i.e., hunting and trapping) for reducing conflict with carnivores in urban environments. I do not have data to address this third objective but my goal in discussing this is to engage members in the audience about their experience and what role traditional management methods might play on affecting behavior of urban carnivores.

Best Management Practices for Trapping in the United States: An Overview and Update

Bryant White, Association of Fish and Wildlife Agencies, c/o Missouri Department of Conservation 3500 East Gans Road Columbia, MO 65201

Best Management Practices for Trapping in the United States (BMP) have been under development since 1998. Research to develop trapping BMPs was undertaken by the Association of Fish and Wildlife Agencies (AFWA) partly as a response to the European Union's ban on the import of furs from countries continuing to use foothold traps. BMPs will identify and recommend the most humane, efficient, selective, safe, and practical trapping devices. BMPs will serve as a standard that can be voluntarily adopted and used by state and federal wildlife agencies, trapper organizations, and individuals to improve trapping, trapper education, and furbearer management programs. The AFWA Furbearer Resources Technical Work Group has identified and prioritized 23 species of furbearers for trap testing. Over 100 trap types have been tested through the assistance and participation of 41 state fish and wildlife agencies. Best Management Practices for Trapping beaver, bobcat, coyotes in the eastern U.S. (revised), coyotes in the western U.S. (revised), fisher, gray fox, American marten, mink, muskrat, nutria, raccoon, red fox, river otter, opossum, striped skunk, swift/kit fox, weasels and an Introduction BMP have been published. Completion of BMPs for ringtails and Canada lynx are expected in 2011. Other projects conducted during BMP development include the Trapping Matters Workshop, new Web-based Trapper Education Program, Train the Trainers Workshop, National Trapper Education Program, Ownership and Use of Traps by Trappers in the United States, National Furbearer Harvest Database and numerous other projects that support regulated trapping in the U.S.